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**EXPANDING THE ROLE OF EMERGENCY MEDICAL
SERVICES IN HOMELAND SECURITY**

by

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EXPANDING THE ROLE OF EMERGENCY MEDICAL SERVICES IN HOMELAND SECURITY

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iii

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ABSTRACT

Emergency Medical Services (EMS) has an established nationwide workforce that has not participated in homeland security as a full partner. EMS is a profession in transition that is looking to establish its identity and expand in ways that enhance its overall mission. This thesis explores the role of EMS in response, recovery, acting as intelligence sensors, participation in fusion centers, and syndromic surveillance to see if there are practical applications and logical integrations that could provide value to homeland security. EMS has an opportunity to take advantage of new models and technologies to meet the needs of the citizens and to improve the outcomes of patients. EMS should consider what expanded roles in homeland security enhances the EMS profession, improves security at home, and meets current goals of EMS across the nation. Comparative analysis, application, evaluation, measurement, and vulnerability assessment provided several potential new roles for EMS in homeland security.

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TABLE OF CONTENTS

LIST OF FIGURES

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LIST OF ACRONYMS AND ABBREVIATIONS

ACTIC   Arizona Counter Terrorism Information Center

CAD   Computer Assisted Dispatch

CDC   Centers for Disease Control

DHS   Department of Homeland Security

EARS   Early Recognition and Deterrence System

EMS   Emergency Medical Services

FEMA   Federal Emergency Management Agency

FBI   Federal Bureau of Investigation

H1N1   Influenza a Virus

HIPAA   Health Information Portability and Accountability Act

MCI   Mass Casualty Incident

MMRS   Metropolitan Medical Response System

MOU   Memorandum of Understanding

NHTSA   National Highway Traffic Safety Administration

PPE   Personal Protective Equipment

SARs   Suspicious Activity Reports

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EXECUTIVE SUMMARY

Emergency Medical Services (EMS) has an established nationwide workforce that has not participated in homeland security as a full partner. EMS is a profession in transition that is looking to establish its identity and expand in ways that enhance its overall mission. EMS has not fully participated in homeland security for a number of reasons. One main reason is that the current model of EMS delivery is a fragmented system that is represented by a variety of entities, such as the private sector, fire departments, municipal systems, hospital based systems, and more. This fracturing of system types leads to a lack of consensus and poor representation of EMS on a federal level. As a result of this poor representation, EMS has received less than four percent of homeland security grants funding to date. This lack of funding is despite the fact that EMS is one of three major disciplines that will respond to terrorist events when they occur along with fire and law enforcement. Along with the lack of funding is a lack of participation. EMS agencies nationwide have not been fully trained, equipped, or been readied to deal with terrorist types of events.

Are there new roles for EMS to play in homeland security that could provide positive results? This thesis explores the role of EMS in response, recovery, EMS personnel acting as intelligence sensors, EMS participation in fusion centers, and the use of EMS data in syndromic surveillance to see if there are practical applications and logical integrations that could provide value to homeland security. EMS has an opportunity to take advantage of new models and technologies to meet the needs of the citizens and to improve the outcomes of patients. Some of these technologies could be applied to homeland security issues. EMS should consider what expanded roles in homeland security enhances the EMS profession, improves security at home, and meets current goals of EMS across the nation. Comparative analysis, application, evaluation, measurement, and vulnerability assessment provided several potential new roles for EMS in homeland security. Both EMS and homeland security entities should evaluate what new roles will improve outcomes and enhance security operations here at home.

Since the discipline of EMS was formalized, not many changes have occurred in the role and basic model of response and transport of patients. EMS as a discipline is now looking at enhanced ways of providing value in the communities they serve, such as instituting new models of medical care, i.e., critical care transport paramedics and community paramedics that will meet the needs of patients in new and innovative ways. One other avenue of enhancing services of EMS is to find new ways to contribute to homeland security. This is a natural progression with the established role of EMS in man-made and natural disasters. Improved ways of responding to disasters that improve patient outcomes and increase the capabilities of disaster teams is necessary. Expanding the role of EMS personnel in recovery efforts could help communities become more resilient and recover faster. The use of EMS personnel as intelligence sensors could boost current intelligence gathering capabilities, since EMS personnel are in a unique position to observe terrorists in crisis and see things others may not see. This intelligence that EMS provides should be connected to fusion centers and evaluation of medical data should be interpreted within fusion centers by medical professionals such as EMS personnel. Also, EMS data from dispatch systems and run reports could be useful in syndromic surveillance systems to provide early warning of potential terrorist or naturally occurring events. Specific recommendations have been made for each of these areas to implement change and to provide opportunities for research of best practices in each area. Also benefits, costs, opposition, and implementation strategies are discussed with recommendations for further research in many areas.

EMS has an opportunity to integrate into the larger homeland security effort that would increase responsibility in response to disasters and in recovery issues. EMS is an untapped resource in intelligence gathering and the flow of information in fusion centers. EMS data has the potential to provide early indicators to look into the beginnings of a possible threat from terrorists or a naturally occurring disaster event. All of these additional new roles in homeland security have the potential to enhance the value of EMS in homeland security and to help EMS establish its national identity.

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I.   INTRODUCTION

Freedom is a fragile thing and is never more than one generation from extinction. It is not ours by inheritance; it must be fought for and defended constantly by each generation, for it comes only once to a people. Those who have known freedom, and then lost it, have never known it again.

– Ronald Reagan

Emergency Medical Services (EMS) in the United States is a relatively young profession that is in transition in many ways. With healthcare reform and a limited economy, EMS is reshaping how it responds and what roles it is playing in prehospital medicine. One of these areas of possible expansion and participation is in the realm of homeland security. EMS has played a relatively small role in homeland security up to this point. Since EMS is involved in many issues that directly relate to homeland security, it is time to re-evaluate that role and to discover if there are areas where new ways of linking to homeland security and improving connections to other disciplines within the security mechanisms of the United States. EMS has compelling reasons to consider being more involved in homeland security because EMS will be called whenever mass casualties occur in terrorist events and natural disasters. Also EMS has a workforce in place that can naturally adapt to homeland security improvements, such as being intelligence sensors for terrorist events. In addition, EMS personnel who already exist in communities can improve the potential for recovery and resilience. Is Emergency Medical Services not as fully involved in the homeland security enterprise as it should be?

We have just passed the ten-year anniversary of the 9/11 attacks, and it provides us with an opportunity to look back and evaluate our effectiveness as a nation in homeland security. In many areas, significant progress has been made in defining and responding to what terrorist threats are and how threats are carried out. One area where significant progress has not been made is in emergency medical services. EMS is one of the three main responder agencies along with law enforcement and fire that are first on the scene of terrorist actions. EMS has not fully participated in homeland security issues

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since 9/11. EMS has continued to provide its traditional function of response and transport, but EMS has not taken on new roles to support homeland security efforts

A.   BACKGROUND AND OVERVIEW

The first prehospital care began just after the civil war in a few large cities in the United States. These horse drawn carriages were provided by large hospitals that needed transport for patients to and from their hospital. No formal model or process existed beyond sporadic efforts by some hospitals in larger cities. EMS prior to the 1970s in the United States was totally unregulated. Prior to the '70s, most medical care that was provided prehospital was provided by funeral homes when they were not conducting funerals or body recovery. Since they had stretchers in their vehicles, they were the logical ones to provide transport of ill and injured people to the hospital. Very little, if any, training was provided and no licensing of personnel was available. Occasionally, if there was a large or particularly severe incident, nurses and doctors from hospitals would respond, but that was rare, and they had no equipment or training to work in the field environment. The only medical model that was successful in the early twentieth century was the military with field medics that were assigned to each battalion.

In 1966, a historic article was published by the National Academy of Sciences entitled "Accidental Death and Disability: The Neglected Disease of Modern Society," commonly referred to as "the White Paper."[1] This article would prove to be a turning point in prehospital care that caused the federal government to begin efforts to create a formal EMS process in the United States to improve prehospital medical care and reduce mortality and morbidity. Since EMS involved transport, it seemed logical at the time to place a new EMS agency at the federal level in the Department of Transportation. An EMS division was created under the National Highway Traffic Safety Administration (NHTSA).[2] The regulation of EMS on a federal level remains to this day within NHTSA.

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[1] Committee on Trauma and Committee on Shock, "Accidental Death and Disability: The Neglected Disease of Modern Society," *The National Academy of Sciences* (July 1966, 1966), 1–44.

[2] "National Highway Safety and Traffic Administration," U.S. Government, http://www.nhtsa.gov/ (accessed December 28, 2012).

Many within EMS today believe that EMS should be moved to a separate division that more fully represents EMS on the federal level[3] and more aligns with medicine. This ongoing discussion will not be resolved for years.

With EMS being a discipline that has only existed for a little over 40 years, the structure of EMS is still expanding and trying to find its way. EMS has evolved in fits and starts and is provided on a daily basis within a fractured structure that varies based on what works in different regions, states, and cities. While there is an overall framework that is provided by the federal government regarding training of EMS personnel, the main daily regulation is provided on a state by state basis, except in California and two other states, where EMS is county based. Within this framework and state regulation, there are a variety of players that provide EMS based on politics, economics, and citizen expectation within regions, cities, and other jurisdictions.

EMS is currently provided by private-for-profit agencies, some of which are national in scope while others are small mom and pop businesses that are local. Some hospitals in the United States still provide ambulance service that varies from small agencies that only service hospital patients to city and county wide systems that are hospital based. Other EMS services are provided by fire departments. These agencies also vary from national companies that provide both fire and EMS services to local city and county agencies that only provide services to their local citizenry. Then there are independent EMS agencies that are either government based or nonprofit that provides EMS services on a regional or local basis. These services could be city, county, or a consortium of government areas that work together to provide a single EMS system. In addition to the variety of services that exists above, each of these services could be either a fully paid entity, it could be fully volunteers, or it could be a mixture of the two. This fractured model of service providers is important to acknowledge so that an understanding can be provided for why it is difficult, if not impossible, for these disparate EMS agencies to agree on a single method of service delivery or to agree to provide a

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[3] Leeanna Mims, "Improving Emergency Medical Services (EMS) in the United States through Improved and Centralized Federal Coordination" (Master's in Security Studies, Naval Postgraduate School, Center for Homeland Security and Defense).

single voice to congress or the citizens on what EMS is and how if functions. While each of these service delivery models can work well in each individual community, it is nearly impossible for all or even a majority of these agencies to come to consensus on legislation or regulation with so many political and vested interests. This is a critical reason why EMS organizations cannot achieve consensus or speak with a unified voice to request federal homeland security funding or be fully integrated in planning, response, recovery, and other efforts related to the homeland security enterprise. The homeland security enterprise would be defined as all aspects of homeland security that includes terrorism deterrence, terrorism response, intelligence, research, strategy, planning, and other aspects directly related to protecting the United States. This enterprise includes many federal, state, and local agencies and processes.

Many EMS personnel have not received adequate training or equipment to respond to terrorist type events and have not been fully included in planning efforts for disasters. With tough economic times in the past few years, many EMS agencies only have the capabilities to respond to the normal daily load of calls and are not ready for surge type of events with mass casualties or unusual circumstances such as chemical, biological, nuclear, or radiological events. In addition, many EMS agencies are not equipped or prepared for events that present large numbers of pediatric patients[4] or other specialized circumstances. All of this is complicated when events occur in rural areas where EMS systems have very limited resources and many personnel have had less training than in more urban areas.[5] While some EMS systems have had some training and have been provided with some equipment through the Department of Homeland Security, that training and equipment is sporadic and is concentrated in the more populated areas of the country. There are no current matrix or measurement tools available that provide a clear understanding of where EMS agencies and personnel stand in relation to how trained they are for disaster response and what their state of readiness is for any mass

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[4] Steve Shirm et al., "Prehospital Preparedness for Pediatric Mass-Casualty Events," *Pediatrics; Official Journal of the American Academy of Pediatrics* 120, no. 4 (2007), 756–761.

[5] Paul Furbee et al., "Realities of Rural Emergency Medical Services Disaster Preparedness," *Prehospital and Disaster Medicine* 21, no. 2 (2006), 64–70.

casualty event.[6] It is critical that measurement metrics and methodologies be developed to evaluate the ability of EMS personnel and agencies to respond in an acceptable manner regardless of size or location.[7] Disaster response and readiness for disaster response should be measurable and benchmarks for effectiveness in varying disaster situations should be able to be applied before, during, and after specific events occur.[8] These measurements can guide funding, education efforts, and standardize equipment, so that protocols of EMS agencies and how they respond are similar and provide an effective outcome for patients.[9] Currently, these methodologies of measuring EMS effectiveness do not exist,[10] and it is difficult to determine what is working well without adequate tools to compare agencies and to gauge effective outcomes.[11]

An improved model of integration of EMS into homeland security needs to be provided. All EMS systems must, regardless of size and structure, be provided with adequate training and equipment to meet minimal requirements to respond to a wide variety of disasters. Roles of EMS providers must be more clearly defined and expanded to meet overall system goals and to reduce mortality and morbidity. With limited resources available within all public safety disciplines, all personnel and equipment resources must be utilized to the greatest extent to meet current demand and to increase successful outcomes. Maximizing the capability of current EMS resources to augment overall response will provide efficiencies and provides a more cohesive response in the

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[6] Christina Catlett, J. Lee Jenkins, and Michael G. Millin, *Role of Emergency Medical Services in Disaster Response: Resource Document for the National Association of EMS Physicians Position Statement* (Philadelphia, PA: Prehospital Emergency Care: Official Journal of the National Association of EMS Physicians and the National Association of State EMS Directors, 2011).

[7] Ross W. Elliott, "Measuring Disaster Preparations of Local Emergency Medical Services Agencies" (Masters of Security Studies, Naval Postgraduate School).

[8] Lori Moore, "Measuring Quality and Effectiveness of Prehospital EMS," *Prehospital Emergency Care* 3, no. 4 (1999), 325–331.

[9] Michael R. Sayre et al., "The National EMS Research Strategic Plan," *Prehospital Emergency Care* 9, no. 3 (2005), 255–266.

[10] James Dunford et al., "PERFORMANCE MEASUREMENTS IN EMERGENCY MEDICAL SERVICES," *Prehospital Emergency Care* 6, no. 1 (2002), 92–98.

[11] Markku Kuisma et al., "Customer Satisfaction Measurement in Emergency Medical Services," *Academic Emergency Medicine* 10, no. 7 (2003), 812–815.

face of disasters. Bringing all EMS personnel and agencies up to a common national standard for response and expanding their roles in logical and practical ways can provide real value to homeland security planning, response, and recovery. EMS personnel can augment other current roles in planning, response, and recovery efforts. The goal is to maintain as much resilience as possible in the light of impending disasters in local populations. To achieve this, limited resources must be leveraged within each community to meet goals and achieve improved outcomes. With specific, focused training and specific, targeted equipment, EMS personnel and agencies can augment current practice in innovative ways that provide real value and positively impacts the lives of individuals impacted by adverse events in disasters, including terrorist attacks.

This thesis will cover five areas of possible improvement for expansion of EMS roles in homeland security events. These areas will include expanded roles of EMS in response, recovery, intelligence gathering, fusion center participation, and syndromic surveillance. Each of these areas will be examined independently and analyzed with specifics provided regarding costs, training, and specific needs for each option.

EMS has a workforce of nearly 900,000 professionally trained personnel.[12] Not all EMS personnel have been fully trained, equipped, or used to their potential to either respond to or prevent terrorist threats. EMS has been underfunded as a discipline and largely ignored as a profession and as a partner in homeland security events and should be included with other agencies in planning, response, and operations. EMS could be considered an underutilized resource of thousands of personnel that could be mobilized in different ways that could fill an expanded role for EMS and contribute to homeland security. A national strategy for expanding the role of EMS in homeland security needs to be developed and initiated. Research is needed to determine the best practices for including EMS as a productive partner in identifying terrorist threats, monitoring syndromic surveillance, improving response to terrorist events, and medical evaluation of intelligence in fusion centers. Additional benefits from this research will be a model of including other disciplines in the intelligence process that may encompass public health,

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[12] Greg Mears, "2011 National EMS Assessment," (2011), 90–1–550.

public works, public utilities, and other agencies that could contribute to the overall enterprise of homeland security. Leaving out EMS could be a strategic mistake that could ultimately put the nation at risk and cost lives in an event.

EMS, as an industry, should consider an expanded role in homeland security. EMS is a young profession and is currently looking to establish a national identity.[13] Part of that identity could include several nontraditional roles within the spectrum of planning, response, recovery, and leadership within homeland security. Missing the EMS patient care perspective, and more, could result in increased mortality and morbidity and could result in longer recovery period for unprepared communities. EMS could possibly provide a new perspective in mitigation, prevention, and response to terrorist events and naturally occurring disaster. Increased participation at all levels of the homeland security enterprise has the potential to result in benefits for both homeland security and EMS.

B. RESEARCH QUESTIONS

How could EMS expand its role to contribute to homeland security in a manner that will enhance the overall function of the homeland security enterprise?

- What are the arguments for EMS involvement in intelligence gathering, fusion centers, expanded models of response, expanded models of recovery, and use of EMS data in syndromic surveillance to enhance homeland security?

- What are the arguments against EMS involvement in intelligence gathering, fusion centers, expanded models of response, expanded models of recovery, and use of EMS data in syndromic surveillance to enhance homeland security?

C. RESEARCH OBJECTIVES

There is a knowledge gap within the EMS community in understanding the potential that exists for EMS to participate as a discipline in homeland security efforts. EMS has an opportunity to expand their role and contribute to homeland security in valuable and meaningful ways for both EMS and homeland security. There is also a

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[13] *Emergency Medical Services at the Crossroads* (Washington, D.C.: University of Virginia, 2006).

policy problem in that the current homeland security enterprise does not recognize the potential contributions that EMS could provide and the value of EMS participation in a variety of homeland security issues.

The role of EMS in homeland security should be thoroughly investigated because many opportunities are lost and are not being taken advantage of. Costs related to EMS issues are very low and the potential benefits are great. This is an area that cannot be ignored.

A framework can be developed for EMS to work within homeland security to benefit both EMS and homeland security in many ways. Issues will be identified that need further research to determine proper levels of training and education for EMS personnel in homeland security, what the boundaries are in that participation, and where additional research needs to take place for proper utilization of EMS roles and responsibilities with homeland security.

D.   LITERATURE REVIEW

To date, EMS has received four percent or less[14] of total funding that has been available for homeland security over the past ten years.[15] What this translates into is a large population of the response industry, EMS, which is untrained, unequipped, and unprepared to meet their expectations in a disaster event[16] A focus on EMS to not only improve traditional response, but to expand the role of EMS in homeland security issues and to possibly enhance capabilities to make EMS more valuable in the homeland security effort could lead to better outcomes of disaster events. EMS is an underutilized resource of thousands of personnel that could be mobilized in surveillance, intelligence gathering, threat identification, innovative ways of response, and integrated preparedness.

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[14] Sarah A. Lister, *The Public Health and Medical Response to Disasters: Federal Authority and Funding,* United States Foreign Press Center, 2006), 29.

[15] Lauren Simon Ostrow, "The Controversy Over EMS, Homeland Security and the Feds," *Best Practices in Emergency Services* 8, no. 6 (2005), 61–63.

[16] Ali S. Khan, "Public Health Preparedness and Response in the USA since 9/11: A National Health Security Imperative," *The Lancet* 378, no. 9794 (Sep 3–Sep 9, 2011), 953–956.

We need to understand how EMS can integrate these capabilities into homeland security in a meaningful way and how do we fund these efforts. Part of the overall issue relates to all disciplines within homeland security. Currently very little exists in how to measure efficiencies for response and capabilities in homeland security. Dependable matrices are lacking that accurately measure correct response and measure acceptable outcomes on the federal level and particularly within the Department of Homeland Security.[17] This is particularly true of EMS. With a varying structure and vast differences between urban and rural systems, no real tangible measurement tools are available to measure the effectiveness of EMS in a particular circumstance. With no real funding source for EMS homeland security and no measurement tools, how does EMS do what is expected of it? How can we achieve mission expectation and expanded goals of EMS utilization in homeland security issues in the current downward funding trend we have today? This literature review is broken down into five component parts, response, recovery, intelligence gathering, fusion center participation, and syndromic surveillance.

The five areas identified above are areas of improvement that have the potential to provide positive results in an immediate fashion that will augment the current systems that are already in place. Many of the recommendations use current staff, equipment, and training with extended utilization and expanded roles added to what currently exists. Improvements were studied and researched that were practical in nature and would provide real value to improve outcomes of the citizens in the event of a terrorist or naturally occurring event. Also, new technologies were included that provide examples of best practices for EMS as a discipline to add to its current repertoire. With current expansion in EMS roles in many different areas, now is an ideal time to introduce these new roles to round out the contribution that EMS provides to communities and to the nation as a whole.

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[17] Elliott, *Measuring Disaster Preparations of Local Emergency Medical Services Agencies.*

1. Intelligence Gathering

EMS could be used as intelligence sensors to help identify terrorist threats and to prevent potential danger from illegal behaviors. EMS personnel are frequently first on the scene of medical and trauma scenes where illegal or life threatening activities are being planned and executed. Michael Petrie in *The Use of EMS Personnel as Intelligence Sensor: Critical Issues and Recommended Practices*[18] believes that EMS personnel could collect information that would be useful to intelligence fusion centers. Since EMS personnel respond to emergencies, potential terrorists often would not have time to cover their tracks before EMS arrives. If trained properly in threat identification, EMS personnel could provide valuable information that could possibly avert a terrorist event.

2. Fusion Center Participation

There are several aspects of EMS data that could provide valuable information to local fusion centers.[19] Data that is not specific to patient care could be utilized to supplement other data that could provide a full picture of a pending terrorist event or one that is unfolding.[20] Individual data and reports from medics, when EMS personnel are used as intelligence sensors, is one application of this process. Others could include 911 data, aggregate run report data, and connections with public health[21] to provide information with a medical view that could add to law enforcement information.

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[18] Michael Petrie, "The use of EMS Personnel as Intelligence Sensors: Critical Issues and Recommended Practices," *Homeland Security Affairs Journal* 3, no. 3 (September 2007).

[19] James F. Morrissey, "Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers," (Master's in Security Studies, Naval Postgraduate School).

[20] Todd Stout, "Data, Fusion and the 911 Center," *Emergency Number Professional Magazine*, no. May, 2005 (2004).

[21] Barry S. Levy, *Terrorism and Public Health: A Balanced Approach to Strengthening Systems and Protecting People*, eds. Barry S. Levy and Victor W. Sidel (New York, NY: Oxford University Press, 2003), 49–61.

Integrating medical and health into fusion center analysis could strengthen the overall process of data evaluation.[22] Data provided to EMS providers could also help keep EMS personnel safe.[23]

3.   Response

EMS has not been widely studied in regards to homeland security. There is not a large body of literature that looks specifically at EMS agencies and their mission and preparedness in regards to disaster operations. There is some comparable literature that relates to public health and fire services that can be studied.[24] In the literature that is available, it is clear that most EMS agencies in North America are not prepared for mass casualty incidents (MCI),[25] or for incidents that involve biological, chemical, and radiological emergencies.[26,27] Many EMS personnel have never been trained in approaches to hazardous materials and do not have the personal protective equipment (PPE) available to protect them in the event of a hazardous materials incident.[28] While incidents such as radiological disasters are rare, a high level of expertise is needed to respond appropriately, and many EMS personnel are not prepared for that response.[29] There is also a high cost associated with adequate preparation for these types of incidents.

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[22] Yonah Alexander, *Terrorism and Medical Responses: U.S. Lessons and Policy Implications*, eds. Yonah Alexander and Stephen D. Prior (New York, NY: Ardsley, 2001), 181.

[23] Thomas J. Richardson, "Identifying Best Practices in the Dissemination of Intelligence to First Responders in the Fire and Ems Services" (Masters in Security Studies, Naval Postgraduate School).

[24] Dennis D. Jones, "Defining the Role and Responsibility of the Fire Service within Homeland Security" (Masters in Security Studies, Naval Postgraduate School).

[25] Elliott, *Measuring Disaster Preparations of Local Emergency Medical Services Agencies.*

[26] Scott Phelps, "Mission Failure: Emergency Medical Services Response to Chemical, Biological, Radiological, Nuclear and Explosive Events," *Prehospital and Disaster Medicine* 22, no. 4 (July–August 2007).

[27] C. Norman Coleman and Nicole Lurie, "Emergency Medical Preparedness for Radiological/Nuclear Incidents in the United States," *Journal of Radiological Protection* 32 (2012), 27–32.

[28] Joshua Sherner, *Terror and Medicine: Medical Aspects of Biological, Chemical and Radiological Terrorism* (Lengerich, Germany: Pabst Science Publishers, 2003).

[29] Fred Henretig, "Biological and Chemical Terrorism Defense, A View from the "Front Lines" of Public Health," *American Journal of Public Health* 91, no. 5 (May 2001).

EMS personnel are not comfortable responding to these types of events[30] and have a high chance of becoming part of the problem during a hazardous materials incident rather than part of the solution. Protecting responders[31] during such events including radiological, nuclear, chemical, biological, and explosive[32] is difficult without adequate training[33], equipment, and knowledge when an unexpected event including these components exists.

Also, rural EMS agencies are less prepared than their current urban counterparts.[34] With smaller populations and fewer resources, responding to large mass casualty incidents is more difficult for the rural EMS provider. Research has shown that in many rural settings, EMS will be overwhelmed with a multiple casualty incident of as few as five people injured. Thirty eight percent of the respondents to this research stated that their EMS system had been overwhelmed by patient count in the past year.[35] In addition, EMS does not have plans or equipment to respond to disasters involving special populations such as pediatrics.[36] Response is the traditional role of EMS in all incidents; however we find that many agencies across North America are unprepared for the most common expectation we have of them.[37] The question is: If EMS providers are unprepared, how will patients get from incident scenes to definitive care without

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[30] Michael J. Reilly, David Markenson, and Charles DiMaggio, "Comfort Level of Emergency Medical Service Providers in Responding to Weapons of Mass Destruction Events: Impact of Training and Equipment," *Prehospital and Disaster Medicine* 22, no. 4 (July-August 2007).

[31] Tom LaTourrette, *Protecting Emergency Responders, Volume 2: Community Views of Safety and Health Risks and Personal Protection Needs* (Santa Monica, CA: Rand, 2003).

[32] Daniel Kollek, Michelle Welsford, and Karen Wanger, "Chemical, Biological, Radiological and Nuclear Preparedness Training for Emergency Medical Services Providers," *Canadian Journal of Emergency Medicine* 11, no. 4 (2009).

[33] Italo Subbarao et al., "A Consensus-Based Educational Framework and Competency Set for the Discipline of Disaster Medicine and Public Health Preparedness," *Disaster Medicine and Public Health Preparedness* 2, no. 1 (2008), 57–68.

[34] Furbee et al., *Realities of Rural Emergency Medical Services Disaster Preparedness*, 64–70.

[35] Mears, *2011 National EMS Assessment*, 1–550.

[36] Shirm et al., *Prehospital Preparedness for Pediatric Mass-Casualty Events*, 756–761.

[37] Catlett, Jenkins, and Millin, *Role of Emergency Medical Services in Disaster Response: Resource Document for the National Association of EMS Physicians Position Statement*, 420–425.

competently trained EMS responders?[38] Some have suggested a consensus based educational framework for all medical and public health disciplines that respond to disasters. Including EMS as a viable partner in a cooperative effort that included all aspects of medical response could improve the overall response of EMS.[39] Success also depends on interdependence within the greater medical community. EMS must fit in with other medical components to fill the void in a complete and appropriate manner.[40] There has been some research into components of the EMS system, such as the fire service and the Metropolitan Medical Response System.[41] This research applies to some degree with EMS, and it shows that not all components are at appropriate readiness levels to meet demand in a disaster. What has been found is that one of the best indicators of system readiness for EMS systems is their ability to maintain day-to-day operations in a strong and competent manner. Multi-hazard planning also leads to better overall disaster outcomes.

The potential exists for EMS to be utilized in other nontraditional and innovative ways to respond to and prevent disaster events. This expanded role for EMS could enhance the value that EMS contributes to the homeland security effort, thus making them more worthy of funding. First, EMS could be utilized in other nontraditional response methods.[42] One possible concept that could provide real value in a disaster is the use of telemedicine[43] with direct physician involvement from a distance.

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[38] . *Emergency Medical Services Outcomes Evaluation* (Washington, D.C.: United States National Highway Traffic Safety Administration, 2003b).

[39] Marcia Crosse, "National Preparedness: Improvements Needed for Acquiring Medical Countermeasures to Threats from Terrorism and Other Sources," *United States Government Accountability Office, Oct 2011, iii+52 Pp.* (Oct 2011).

[40] Robert Berne, *Emergency Medical Services: The Forgotten First Responder* (New York City, NY: New York University, Center for Catastrophe Preparedness and Response, [2005]).

[41] *Preparing for Terrorism: Tools for Evaluating Metropolitan Medical Response System Programs*, ed. Institute of Medicine, Committee on Evaluation of the Metropolitan Medical Response Program E-Brary Electronic Book Collection, 2002).

[42] Robert A. Burke, *Counter-Terrorism for Emergency Responders*, 2nd ed. (Boca Raton, FL: Taylor and Francis, 2007).

[43] Wei Xiong et al., "Implementing Telemedicine in Medical Emergency Response: Concept of Operation for a Regional Telemedicine Hub," *Journal of Medical Systems* 36, no. 3 (June 2012), 1651–1660.

Implementing a telemedicine solution with EMS personnel as the hands and eyes of the physician[44] using cameras and digital instruments could allow for a better flow of ill and injured people to nontraditional destinations other than hospital emergency rooms.[45] Telemedicine has great potential to provide medical enhancement of care through direct intervention of trained physicians that are available via video connections and with use of EMS personnel on the scene as the eyes and hands of physicians.

4. Recovery

In addition, EMS could play a strong role in recovery efforts from a terrorist attack or a naturally occurring disaster. After a disaster occurs, the current role of EMS diminishes and EMS systems return to a normal mode of function. Of course, communities are not back to a normal level of function. EMS personnel could provide assistance in many ways to move the community back toward normal activities. With the special skill sets of EMS personnel, they could significantly contribute to recovery efforts.[46] Providing public health assistance could greatly accelerate recovery efforts. EMS personnel could be cross trained to fill certain roles after the disaster has passed.[47] With the tools and resources available to EMS, real time information could be transmitted to incident commanders so that correct and comprehensive assistance can be provided to the community to speed recovery and bolster resilience.[48]

5. Syndromic Surveillance

In addition to these possible enhancements, EMS data could be useful in surveillance of threat assessment information. The President of the United States recently

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[44] Hui Wang et al., "Concept of Operations for a Regional Telemedicine Hub to Improve Medical Emergency Response" (Austin, TX, Winter Simulation Conference, 2009).

[45] *The Joint Advisory Committee on Communications Capabilities of Emergency Medical and Public Health Care Facilities* (Washington, D.C.: United States Congress, 2008).

[46] Gregory Bennett, *Cross-Training for First Responders* (Boca Raton, FL: Taylor and Francis, 2010).

[47] Burke, *Counter-Terrorism for Emergency Responders.*

[48] Logan Hauenstein et al., "A Cross Functional Service Oriented Architecture to Support Real Time Information Exchange in Emergency Medical Response" (New York, NY, EMBS Annual International Conference, Aug 30–Sept 3, 2006.

issued the National Strategy for Biosurveillance.[49] This report defines biosurveillance as "the process of gathering, integrating, interpreting, and communicating essential information related to all-hazards threats or disease activity affecting human, animal, or plant health to achieve early detection and warning, contribute to overall situational awareness of the health aspects of an incident, and to enable better decision making at all levels." EMS holds the potential to be at the forefront of this effort since EMS is many times the first contact of patients across the United States with the healthcare system.[50] Software could be added to EMS dispatch and electronic run reporting records to search for patterns that would indicate a biological or chemical attack or a pandemic.[51] This could provide early warning of a local or wider process that is unfolding in real time and will need to be addressed and contained.[52] Early warning could save lives by alerting the proper authorities and giving them valuable time to respond appropriately[53][54].[55] Since EMS data is early in the medical process, the potential exists for a higher level of false positives due to a lack of specificity. This is why EMS data would serve as an early indicator of issues to take a look at; all positives in EMS data may not indicate that actions need to be taken. This issue addresses why more study is needed on what specific data points indicate potential threats and what threshold levels indicate an ongoing event that needs intervention.

[49] *National Strategy for Biosurveillance* (Washington, D.C.: The White House, 2012).

[50] Alex Garza G., "Real Time EMS Events as Surrogate Events in Syndromic Surveillance," *Advances in Disease Surveillance Journal* 4, no. 7 (2007).

[51] Jonnathan Busko, "EMS and Medical Surveillance," Elsiviere Publishing, http://www.emsworld.com/article/10322103/ems-and-medical-surveillance (accessed February 20, 2012).

[52] Kelly J. Henning, *What Is Syndromic Surveillance?* (Atlanta, United States, Atlanta: U.S. Center for Disease Control, 2004).

[53] Lauren Simon, "Swift, High-Tech Response Keeps EMS on Top of Swine Flu Outbreak," *Best Practices in Emergency Services* 12, no. 7 (July 2009), 1–2.

[54] Leonard Roberts, *Tracking Infectious Disease with EMS Agency Real-Time System Data* (Seattle, WA: Seattle Fire Department, 2010).

[55] Phillip Leggiere, "High Stakes Security," *HS Today* Volume 2, Number 6, no. June 2005, 29–39.

Finally, EMS has the potential to participate in preparedness and planning for disasters in all of these areas. EMS expertise and experience would be valuable additions to many planning and preparedness processes that currently do not include them.

The literature generally points to an underfunded EMS work force that is not equipped or trained to deal with mass casualty and disaster types of operations.[56] Very little has been written about expanded roles of EMS and very little research has been initiated in this area.

6.   What Is Not Known

There is currently no data on what useful information could be obtained by EMS personnel that could be utilized by a fusion center to identify terrorist activity.[57] If EMS responders do not have the training or skills to identify chemical, biological, bomb, or other terrorist tools or tactics, we will not know if any terrorist events could have been averted. With very few EMS agencies included in fusion center activities[58] and no data on those activities, it is impossible to determine if it has been advantageous to have EMS involved in the process. In addition, EMS involvement in fusion center activities could improve overall data and could provide valuable information back to EMS personnel in the field to keep them safe with up-to-date knowledge of potential terrorist threats and activities. No data currently exists to show what roles and responsibilities would be advantageous to both EMS personnel and fusion centers.

While we understand EMS operations on a daily normal level, we do not know what exactly is required for disaster preparedness and operations for individual EMS agencies.[59] There is no accepted matrix or measurement tool available that has been

[56] Ostrow, *The Controversy Over EMS, Homeland Security and the Feds*, 61–63.

[57] Morrissey, *Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers, 2007.*

[58] Crosse, *National Preparedness: Improvements Needed for Acquiring Medical Countermeasures to Threats from Terrorism and Other Sources, 2011.*

[59] Joseph A. Barbera, Anthony G. Macintyre, and Craig A. DeAtley, *Ambulance to Nowhere: America's Critical Shortfall in Medical Preparedness for Catastrophic Terrorism* (Washington, D.: George Washington University John F. Kennedy School of Government, 2001).

developed to successfully evaluate preparation, training, and optimal equipment levels for disaster operations for EMS. The literature finds authors with opinions about the readiness of EMS across the nation; however, it lacks hard research and numbers to validate their conclusions. Currently, there are no local, state, or national standards that EMS agencies use to measure their readiness for MCI's or guidelines for EMS to look at how they should respond to hazardous materials incidents.[60] There has been no comparison between urban, suburban, and rural EMS agencies to find a scalable tool that tells them what level of training and preparedness is acceptable and makes them ready for an incident in their jurisdictions. Without consistent measurement tools, individuals, agencies, states, and the federal government cannot accurately identify gaps in response and preparedness and have no tools to identify where funding is needed. The bottom line is we do not know how many lives could be saved if an agency was adequately prepared to respond to any of these disaster types of events.

No data has been collected to determine the best use of EMS personnel after a disaster has passed. Could EMS personnel be utilized in a useful manner that could increase recovery rates of communities and could EMS personnel be trained to meet other needs in the communities they serve? Specific roles could be developed that include the skills of EMS personnel and puts this workforce to valuable use after a disaster. A possible place to start to identify possible expanded areas of use would be each state's scope of practice for EMS personnel. This scope may need to be expanded to cover specific roles that EMS personnel may be well suited to.

Finally, without evidence to show that EMS electronic data from dispatch and run reporting could detect a trend in symptom based problems with patients to reveal a pandemic or terrorist attack, it is impossible to determine if that type of reporting could save lives and improve outcomes. No data is currently being collected or analyzed to find

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[60] United States Congress, House. Committee on Governmental Reform, Subcommittee on National Security, Veterans Affairs, and International Relations., *Homeland Security: Keeping First Responders First: Hearing, July 30, 2002,* Hundred and Seventh Congress sess., 2003, iii+228.

out how timely information reporting could be or how reliable that data is.[61] While many studies are ongoing at this time, none have identified what data elements are helpful or what actions need to be taken when a threshold has been exceeded.

7.   What We Need to Know

With very little research in the field of EMS in relation to homeland security, there are many issues that need to be looked at to determine practical, measureable improvements to be made by EMS providers to fully integrate into the homeland security picture and receive adequate funding to meet all of its mandates. Research needs to be conducted in ways that EMS can expand response modalities in new, innovative ways that enhance life saving and improves risk assessment and management. Universal response measurements must be evaluated and adopted by EMS agencies and evaluators to determine the effectiveness of response to disaster and mass casualty incidents. All of these tools must be scalable to measure small rural to large urban EMS systems.

In addition, we need to determine how EMS syndromic surveillance data could be utilized to improve response to chemical, biological, and disease incidents in real time. Electronic data at dispatch centers and from run reports need to be studied to determine if this data can provide improved outcomes for local or larger pandemic type issues. EMS also needs to evaluate if connections with local and regional fusion centers can provide intelligence information from EMS personnel in the field. Could terrorist incidents be averted with information from EMS sources and lives saved?

Finally, we need to determine the value of EMS involvement in all phases of homeland security planning. EMS has the capabilities and training to participate and contribute in many ways that have not been explored.

.[61] *Syndromic Surveillance: An Effective Tool for Detecting Bioterrorism?* (Santa Monica, CA: RAND, Health Programs, Center for Domestic and International Health Security, 2004).

II. METHOD

In this thesis, five expansion areas for EMS are explored: Intelligence in EMS, inclusion in fusion centers, new EMS response techniques, new roles for EMS in recovery efforts, and syndromic surveillance. Each of these areas includes overlapping and different analysis techniques based on what is applicable to each area. A variety of analysis techniques were utilized. For each of the five areas: Application, evaluation, measurements, and vulnerabilities of the proposed expansions were analyzed where applicable. Techniques were applied including comparative analysis from similar disciplines when those review sources are available, analysis of evaluation processes that can be adapted to EMS, analysis of historical events and inferences within the discipline of EMS, and use of recently proposed theories. The techniques listed may overlap between issues or not apply in specific circumstances, but all have been applied to the extent that information is available and to the degree that the technique is applied appropriately.

Some of the areas have a wealth of available literature to be reviewed and others have very little. The use of a variety of techniques allows a more comprehensive exploration of each area and helps to establish a valid argument for each solution that is proposed. This meta-analysis should produce a more complete picture of issues, applicability, opposition, implementation challenges, and processes. This allows a variety of solutions and evaluations of processes to examine implementation issues that exist within each proposed result. The goal is to provide as complete an analysis as possible and to suggest further areas of study and research.

A. DATA COLLECTION

A literature review was conducted researching the current status of EMS; EMS as intelligence gatherers, EMS receiving intelligence, EMS disaster response models, damage assessment, EMS role in disaster recovery, syndromic surveillance in EMS, public health models, fire based models, EMS and homeland security, and more. Data

were applied to each research question and topic. Any evaluation or measurement model is discussed and applied. EMS journals were researched for topic information and a general search of the literature was performed in fire, nursing, physician, public health and other related medical journals. Key words for research included EMS, emergency medical, EMS response, EMS recovery, EMS today, EMS intelligence, EMS receiving intelligence, EMS disaster response models, damage assessment, syndromic surveillance, public health models, EMS and homeland security, fusion centers, among others.

B.   DATA ANALYSIS

Data were analyzed in each topic area utilizing the methods described above when they applied to each section and indicates what methods were utilized in each section. Not all methods were used with all areas. Analysis includes all expanded roles and complications of adding those roles. Analysis includes costs, practical application, policies, training and education, overall cohesion within the homeland security system, and attitudes of personnel within and outside of EMS regarding expanding roles. Each area was analyzed utilizing all of the above parameters and utilizing literature that is found in the review.

III. ANALYSIS AND EVALUATION—EMS AS INTELLIGENCE SENSORS

There is little research in this particular area of EMS. What research that has been done is a few papers related directly to EMS and more research in relation to fire personnel. Direct reference and comparative analysis of that data will be covered with all aspects cited, which includes both pros and cons of the data provided. In addition, for this area a historical perspective will be explored that observes current practice in EMS related to prevention and mandatory reporting requirements.

A. ACTING AS INTELLIGENCE SENSORS

EMS personnel could act as intelligence sensors with specialized training to identify the tactics and tools that terrorists use so that potential terrorist threats could be averted. EMS personnel enter people's homes and see things no one else sees. EMS personnel observations could be a part of a larger picture that prevents a terrorist event. EMS personnel are currently mainly trained in emergency medicine techniques and issues surrounding emergency response and transport. EMS personnel have little, if any, initial training of any type within their curriculum in terrorist activities, how terrorists operate, or what to look for to detect terrorist activities. There is little to no training that is specified in the National EMS Scope of Practice[62] document from the federal agency that governs EMS, The National Highway Traffic Safety Administration in naturally occurring disasters either, thus leaving most EMS personnel lacking in their response to any natural or manmade disaster. Certainly EMS personnel are not trained in how to detect terrorist activities at any level.

Since EMS personnel respond to emergencies daily, there is a high probability that in specific circumstances some of them may respond to a terrorist who is planning an attack and experiences a medical emergency of one type or another. Since EMS is not considered law enforcement, the terrorist's guard may be down, and they may be

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[62] *National EMS Scope of Practice Model* (Washington, D.C.: U.S. Department of Transportation, National Highway Traffic Safety Administration, 2007).

adversely affected by the medical emergency at hand. Also, potential terrorists may not have the time to "clean" the scene before the arrival of EMS personnel in an emergency. This could lead to the inability to react or could lead to a sense of security that the EMS personnel that respond will not recognize suspicious activities or understand the implications or the signs of terrorist activity. This unique situation provides a perfect opportunity for EMS personnel to observe possible suspicious activities and report them to proper authorities that could result in a diversion or termination of a terrorist event. These actions on the part of EMS personnel could save lives and diminish property damage. The ability of EMS personnel to properly identify a terrorist threat and provide valuable information to authorities would place EMS personnel in an important role within the homeland security enterprise. In addition, EMS personnel are already well trained in matching circumstances to the mechanism of injury. In cases where these circumstances do not match the mechanism of injury, this would cause suspicion on the part of the medic on scene.

If EMS personnel were properly trained, they could detect these discrepancies and possibly identify potential terrorist threats or at least suspicion that is reportable. If EMS personnel were trained in trait-based indicators, behavioral-based indicators, and incident or site based indicators of terrorism, they could possibly identify these issues and report them. Trait-based indicators are based on community or individual characteristics such as race, ethnicity, religion, or national origin. These indicators are less reliable than others, but fit into a larger picture of a terrorist. Behavioral-based indicators are observed in the persons or communities' activities, behaviors, or conduct. Incident or site-based indicators are what someone can see, smell, hear, or sense in some other manner. This includes knowing what to look for and how to identify specific materials that could indicate terrorist activities. Combining all of these techniques can provide a possible picture of terrorist activity and provide a basis for evaluation and possible reporting by EMS personnel on an emergency scene. Many times EMS personnel observe things that

no other responders see. This particularly puts EMS personnel in a unique position to provide valuable information that could possibly divert a terrorist attack.[63]

Some in EMS will state that this is not in the current job description of EMS personnel, and that this is the responsibility of others, specifically law enforcement. Others will argue that this will get in the way of the unique relationship that EMS currently exhibits with its patients. EMS currently experiences in most cases a close trust with patients that disclose personal medical information that they may not even share with their family. This information is confidential, and it is a matter of trust that patients must feel to confide sensitive information with EMS. Many in EMS feel that information provided by a patient has particular relevance and is provided in confidence since the main duty of EMS personnel is to provide high quality emergency care regardless of personal feelings and the issues of right or wrong. The fear is that if the public does not trust their healthcare provider, then they will not seek medical care when it is needed or not provide full information that is needed for treatment that could mean the difference between life and death. In addition, some EMS personnel will feel that providing intelligence on terrorists may provide some opportunities for risk and physical harm to EMS personnel. If terrorists knew that EMS personnel are trained to report suspicious activities, and they know that those personnel observed something suspicious, then it is possible that those personnel could be at risk of injury for that knowledge. These are all real issues that must be addressed in any intelligence gathering role for EMS personnel.

B.   PREVENTION MODELS

There are two current models within EMS that provide some basis for EMS personnel participating as intelligence sensors. First is the current movement of prevention within EMS.[64] EMS agencies across America are today working not just on response and transport of patients, but on how to reduce the total number of ill and

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[63] Petrie, *The use of EMS Personnel as Intelligence Sensors: Critical Issues and Recommended Practices, 2007.*

[64] James S. Weber, "Are You Embracing the New Frontier in Lifesaving?" Cygnus Business Media, http://www.emsworld.com/article/10319741/are-you-embracing-the-new-frontier-in-lifesaving (accessed December 28, 2012).

injured people through a variety of prevention programs. From bicycle training for children, including helmet use,[65] bicycle control and safety rules of the road to classes on heart disease in how to eat right, exercise, and take medications properly. Car seat classes for patents include how to fit the seats properly into vehicles and how and when to buckle children into the car seats.[66] Elder safety training that includes fall reduction,[67] fire hazard education, and many other issues that face the geriatric population provides prevention of a variety of issues that specifically present to our senior population. All of these and more provide a strong push to provide prevention of illness and injury from a variety of sources.

Prevention of a terrorist event could possibly save lives and prevent injury. It can be argued that in the instance of terrorism, EMS personnel have a responsibility to protect the citizens they serve and that this threat could produce mass casualties and should be prevented if at all possible.[68] Some within law enforcement may suggest that EMS personnel should provide intelligence for a variety of issues besides terrorism, such as drug use and other infractions of the law. This thesis suggests that there is a fine line between terrorism and other illegal acts. The purpose is not to make EMS personnel snitches or informants for law enforcement. EMS personnel should not seek to become policemen or policewomen. EMS personnel should focus on their role as EMS providers and allow law enforcement to do their job independently; however, focusing on recognizing terrorist activities specifically has real value and should be included in EMS curriculums and should be taught to all current EMS personnel. Careful attention should be paid to making sure that educational programs in recognition of terrorism is specific and provides an understanding of what should be reported and what should not. A

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[65] "Injury Prevention - Bike Helmet Program," Santa Barbara County Emergency Medical Service Agency, http://www.countyofsb.org/phd/ems.aspx?id=21844 (accessed January 16, 2013).

[66] "Success with Car Seat Check," Durham County Emergency Medical Services, http://dconc.gov/index.aspx?page=163&redirect=1 (accessed January 16, 2013).

[67] "North Huntingdon EMS/Rescue Community Fall Prevention Program," North Huntingdon Township EMS/Rescue, http://www.rescue8.org/fallprevention/ (accessed January 16, 2013).

[68] Alexander, *Terrorism and Medical Responses: U.S. Lessons and Policy Implications*, 181.

cooperative approach is suggested for development of a training program to include EMS, law enforcement, fusion center personnel, terrorism experts, and others that could contribute to this effort.

C.   MANDATORY REPORTING MODELS

The second model within EMS that currently supports reporting of terrorist activities is the mandatory reporting that is required of all EMS personnel for specific issues that are encountered. Some issues, such as child abuse, elder abuse, rape, torture, battery, manslaughter and others are so extreme that EMS personnel are required to report them in all cases.[69] The laws vary from state to state, but all states have mandatory reporting criteria for EMS personnel.[70] This mandatory model of reporting could provide EMS personnel the excuse needed to justify what could be perceived as the sacred code of silence in regards to what could be construed as confidential information of patients. If terrorism is deemed to be on the same level as child abuse, elder abuse, or other specific crimes, this could be a logical progression of justifying reporting without much objection. Using this model, certainly the threat of terrorism and the possibility of death and destruction provide a basis for reporting by EMS personnel of this issue. The ability to divert mortality and morbidity on a potentially massive scale provides a sense of obligation for EMS personnel to participate in a meaningful manner and provide possible information that could diminish or avert an attack of some kind. This fits within the mission of EMS and helps EMS to avoid a mass casualty incident.

D.   PATIENT CONFIDENTIALITY

One other issue surrounding the reporting of terrorist activities is the confidentiality of patient medical conditions and other information protected under federal and state law. The federal Health Insurance Portability and Accountability Act

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[69] S. J. Singley, "Failure to Report Suspected Child Abuse: Civil Liability of Mandated Reporters," *J.Juv.L.* 19 (1998), 236.

[70] Child Welfare Information Gateway, "Mandatory Reporters of Child Abuse and Neglect: Summary of State Laws," U.S. Department of Health and Human Services, Administration for Children and Families, https://www.childwelfare.gov/systemwide/laws_policies/statutes/manda.cfm (accessed January 16, 2013).

(HIPAA),[71] and individual state laws, prohibit certain disclosures of a patient's protected medical information. These laws are very specific and each agency and individual should review the laws that apply to them based on their location. First, the HIPAA law protects a patient's medical information from disclosure by covered entities except in specific circumstances. Almost all EMS agencies in the United States are considered covered entities, and all covered entities must abide by the HIPAA law.

The exceptions to HIPAA include providing information to law enforcement about a crime including victims of that crime, location, the nature of the crime, the perpetrator of the crime, and the description of the crime. EMS personnel can also disclose protected information, if they believe that there is a threat of serious potential harm to an individual or a threat to public safety. Finally, the law allows disclosure of information by EMS personnel, if there is a suspected threat to national security or for intelligence activities related to national security. So, if EMS personnel are convinced that there is suspicious activity related to a medical call, they are authorized under HIPAA to disclose that information to authorities to prevent harm to individuals or the public and to participate in matters of national security. State laws vary based on where individuals live, so each EMS agency should research state laws regarding medical information disclosure. Some states do not allow EMS personnel to disclose protected health information, so caution should be advised in doing so. However, most information that should be reported to law enforcement or fusion centers regarding potential terrorist activity is not medical in nature and is not protected. In most cases, medical information will provide very little in the way of necessary information for law enforcement. What does need to be reported is specific information that leads to a suspicion of terrorism. These are what you observe and what terrorists leave lying around when you arrive on the scene. These trait-based, behavioral-based, and incident or site-based observations are usually all the information you will need to transmit to the proper authorities about possible terrorist activities.

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[71] "The Health Insurance Portability and Accountability Act of 1996," U.S. Department of Health and Human Services, http://www.hhs.gov/ocr/privacy/ (accessed December 28, 2012).

So, while there needs to be careful consideration about what information is disclosed, and how it is transmitted through proper channels, there are significant indications that EMS reporting of possible terrorist activities could be a valuable tool in the fight against terrorism. It is the responsibility of all Americans to stand together in the fight against terrorism here at home and EMS personnel are a large part of the team responsible for taking action. The use of EMS personnel as sensors for intelligence gathering can be useful, if it is focused, and if EMS personnel are well trained in what to look for and how to report it.

E.   OPPOSITION

Some EMS personnel will object to this possible function of EMS. They believe that there is a sacred trust between patients and their medical professionals. They will not want to report suspicious activities to authorities because they believe that reporting patient's activities breaks this trust and will lead to future negative effects for EMS personnel. Many times EMS personnel enjoy a special relationship with patients and want to maintain the trust of the patient, so that the patient will feel free to divulge confidential, even illegal, activities that could affect the outcome of their health. This trust is critical to maintain in the prehospital environment for EMS personnel; however, the sheer magnitude of the threat of terrorism outweighs this component. If EMS is to provide terrorist information to authorities, they must be conscious of what information should be disclosed, and that it is focused on the issue of terrorism and does not fall into the category of general crime control. The objective is not to take over the role of law enforcement, but rather to work together with homeland security to report issues that rise to the level of terrorism and could provide an opportunity to prevent morbidity and mortality. An example of this would be where a paramedic would report identifying bomb making materials, since it could be associated with terrorist activities, but EMS personnel would not report illicit drugs that have been taken by the patient, since this does not pertain to terrorism and could negatively affect a patient's health if not reported by the patient to EMS and physicians.

F.   TRAINING

Training for EMS personnel in identification of terrorist activities should be similar to training available to other first responders in the field today. This training should include trait based indicators, such as ethnicity or race, although these are less reliable and only work in concert with other indicators and information observed. These trait based indicators are important; however, when utilized properly and with the understanding that they must be used in combination with other indicators and not as a standalone system since this can lead to racial profiling, which is not a sound technique. In addition, behavioral based indicators must be taught also. This particular set of indicators work well for EMS personnel, since they are trained in matching patient medical conditions with the patient's story and circumstances that are observed. EMS personnel are very well trained in identifying when a patient's story does not match their circumstance or injuries. Looking for discrepancies in the total picture of a medical call can currently indicate child or elder abuse, or other issues where patients would like to hide the real circumstances behind a medical condition. This training and skill would also apply to terrorist events, if EMS personnel understood how to evaluate the information they were receiving and place it into the greater picture of the event.

Finally, the training for EMS personnel should include site-based indicators. These indicators are specific items that can be observed by personnel on scenes that indicate possible terrorist activities. This would include bomb making materials, chemicals, biological agents and other physical indicators. Currently, EMS personnel may not know what to look for, and even though they may witness something that could be suspicious, they may not have the training and understanding to identify and feel comfortable reporting something they do not understand. Proper training would provide this level of comfort and allow EMS personnel to be accurate when reporting suspicious activities.

G.   THE DUTY TO ACT

Another aspect of this argument is that due to the extreme nature of terrorism, it is the duty of all EMS personnel to report potential terrorist activities, and since it is the mission of EMS to reduce illness, injury, and suffering, preventing anything that could contribute to those conditions can only enhance public safety and reduce death and injury. It could be argued that EMS personnel have an obligation to prevent any destruction when possible, and this reporting of potential terrorist activities would fall within that obligation. It seems that the EMS profession and legislators should have this discussion to determine which obligations are most important and devise a plan to meet all needs of patients in the best manner possible. Weighing patient trust and confidence with potential injury and destruction of terrorist activities is difficult but not impossible to accomplish. This is why it is imperative that EMS personnel be well trained in identifying terrorist traits, and when it would be appropriate to report these issues.

In total, this change in procedure in EMS must be evaluated in state laws across the nation, and EMS personnel must be involved in crafting these laws to clearly identify what terrorism is and when reporting as an intelligence sensor is required. All EMS personnel must have the proper training to properly identify potential terrorist activities, and EMS personnel must have protection when reporting, even when it turns out to be a false report. When something rises to the level of adequate suspicion of terrorism, EMS personnel must feel comfortable reporting these incidents and feel protected no matter what the outcome is. Laws and training must very clearly identify the specific role of EMS personnel in intelligence gathering and what the limits are for them in this role. In addition, there needs to be very specific processes in place, so that suspicious activity reports (SAR's) are uniformly sent in and handled in a routine manner every time. This process of reporting will be expounded upon in the next section of this thesis on fusion centers.

H. BENEFITS

Benefits of reporting suspicious activities that could indicate terrorism are obvious. Stopping or diminishing a terrorist attack could save lives, injuries, and property damage. Preventing any terrorist act from occurring would pay several benefits to EMS and to homeland security at large. Costs would consist of training and a reporting system. Training for EMS personnel would begin with initial training that could vary from 24 to 40 hours depending on the curriculum that is decided on by local EMS and the fusion center. Some ongoing refresher training would probably be necessary, since this is an infrequently used skill.

IV.   ANALYSIS AND EVALUATION—FUSION CENTER PARTICIPATION

Closely tied to intelligence gathering is the participation of EMS in fusion centers across America. Fusion centers currently are a link between various agencies including federal, state, and local to provide a common place of reporting of terrorist activities and a synthesis of data to make sense of what events are unfolding in local communities. Currently, there are 77 fusion centers across the United States. All fusion centers house some law enforcement, if not all law enforcement agencies in the area including state and local.[72] There are usually connections to federal agencies, such as the Federal Bureau of Investigation (FBI) and the Department of Homeland Security (DHS). Some of current fusion centers include other partners that range from fire departments, EMS, public health, private industry and others either as permanent partners or as contacts. This connection to other agencies occurs in various ways with varying ways of involvement. In reality, few fusion centers are currently receiving information from EMS agencies and even fewer are providing information back to EMS agencies in any form.[73] Some fusion centers are law enforcement only due to the lack of connectivity with other outside agencies and a possible lack of trust between disciplines.[74]

A.   MEDICAL ANALYSIS OF DATA

In the previous section, use of EMS personnel as intelligence sensors was discussed. While this is important, just as important is how that information is reported, how the data is analyzed, and what actions are taken as a result of that information being provided? Good information without proper analysis and a clear action plan is useless and could lead to poor outcomes. Medial interpretation of data could be important,

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[72] "State and Major Urban Centers Fusion Centers," U.S. Department of Homeland Security, http://www.dhs.gov/state-and-major-urban-area-fusion-centers (accessed December 28, 2012).

[73] Morrissey, *Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers.*

[74] Jay C. Butler, "Collaboration between Public Health and Law Enforcement: New Partnership for Bioterrorism Planning and Response," *Emerging Infections Diseases* 8, no. 10 (2002).

especially in cases involving chemical, biological, or radiological attacks with specific injuries. Patterns of injury and illness can be an important piece of intelligence data that could help mitigate circumstances and lead to safer responses. With EMS data and intelligence coming into fusion centers in an acceptable process and that data integrated into a complete analysis, a better overall picture of potential threats could be formed. From this process that incorporates EMS, specific warnings and protective information could be disseminated back to EMS personnel to improve response and keep EMS personnel safe.

B.   EMS DATA REPORTING

For EMS, there needs to be a clear understanding of what terrorist trait information needs to be reported, what mechanism will be used to report that information, and how that information will flow and to who. All of this process must be well thought out and provided before reporting occurs. Memorandums of understanding (MOUs) between responding local EMS agencies should be in place before reporting begins to allow all agencies to understand who will be responding to assist one agency when help is requested. Training of all personnel at EMS and the fusion center must occur, so that everyone understands the flow of information and what will be done with information once it is obtained. Training should include what should be reported, what forms will be utilized, what information will be kept confidential, who receives the information, and what the process of analysis is once information is received. EMS personnel should understand that the information they provide is part of a synthesis of information that is gathered from multiple sources and tied together into a file that provides an overall picture of an individual, group, or event. They should also be made aware that information that they provide, no matter how seemingly insignificant, could result in a major breakthrough on a terrorist investigation and could ultimately save lives. What analysts at the fusion center must be aware of is what data they could possibly receive from EMS, and how that data needs to be integrated into the entire picture to be accurate and complete.

C.   PROVIDING INTELLIGENCE BACK TO EMS

In addition, fusion centers must create a mechanism of providing relevant feedback to EMS agencies and personnel when their safety or jobs are compromised by terrorist activities. Some level of reporting back to EMS is necessary to complete the circle of information to make EMS agencies and personnel feel like relevant partners and to provide real time information that could lead to avoidance of dangerous circumstances or areas and heightened situational awareness.[75] This valuable partnership provides synergy within the homeland security enterprise and brings law enforcement and EMS into a closer working relationship that is necessary to be successful in today's fast paced world. Cooperation between EMS and fusion centers will provide trust[76] that is badly needed on a day-to-day operational basis and will lead to improved outcomes if a large event, either natural or manmade is faced by the collective agencies.

In addition, certain key personnel within EMS must be vetted with security clearances, so that they will fit into this new role within the fusion center and meet all guidelines. The key is a well thought out process of information flow into fusion centers, proper analysis with an understanding of EMS, and dissemination of real time information back to EMS that provides situational awareness and collective operational value to EMS. EMS personnel who participate with fusion centers must recognize the importance of their participation and may need to receive some security clearances depending on their level of participation, and they need to understand the constitutional boundaries that limit their use of confidential information and regulate how they participate in information sharing. Fusion centers need to be aware of how information is being reported by EMS personnel and how to analyze that data specific to EMS. Certain demographic data may be straightforward, but medical terminology and phrasing may need to be understood to completely appreciate why something seems suspicious to EMS

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[75] Morrissey, *Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers.*

[76] Thomas J. Currao, "New Role for Emergency Management: Fostering Trust to Enhance Collaboration in Complex Adaptive Emergency Response Systems" (Masters in Security Studies, Naval Postgraduate School, Center for Homeland Defense and Security), 1–103.

personnel. Sometimes a medical analysis of aggregate symptoms and health indicators may need to be understood to accurately analyze and respond to certain patient conditions that indicate biological, chemical, nuclear, or radiological attacks. Fusion center analysts may need EMS knowledge or other medical understanding to totally assimilate all implications of information that they have received. Either having medically trained personnel in the fusion center or having them available for analysis would provide a greater level of understanding and enhance response mechanisms when there is a potential threat.

Finally, fusion centers must understand the local EMS agency and how they function to accurately make recommendations or to provide data that could influence operational decisions or provide situational awareness that is meaningful. One potential use of this data is to provide EMS with "force protection information" along with fire and law enforcement. EMS personnel would need to be able to understand the directives as they are written and this information could be valuable to protect responders from potential threats in the field as they present themselves. This may require an EMS person that is affiliated with the fusion center to translate a bulletin into an understandable format for EMS. Full participation of health components such as EMS, hospitals, and public health can only enhance fusion center productivity and improve outcomes in all areas of terrorism and investigation

D.   TRAINING IN REPORTING

So in addition to recognition training in terrorism, EMS personnel need to understand the process of reporting and how their data will be treated once a report is made. This is a new reporting system to most EMS personnel and training is essential so they understand how to document what they experience and know who to file a report with. Reports need to be confidential and go through a specific process each and every time. EMS personnel will need to feel that their report is treated with respect and given the attention that it deserves. This process probably needs to route EMS SARs to a fusion

center for proper evaluation. Sending reports such as this to a regular police agency will probably result in no understanding of what is being received and no real analysis of the situation.

E.   FUSION CENTER PROCESSES

This is why fusion centers are the agency of choice for EMS documentation of possible terrorist activities. Fusion centers of course must have a process of receiving EMS data and understanding where to fit that data into the overall picture of an investigation. Medical analysis must be available, if needed, and then a process of feedback to EMS should be provided when it is necessary and appropriate. EMS agencies and personnel need to feel that they are a part of the process and in providing potentially valuable information; they will receive back safety and warning data that could affect their response. This loop of information is important to the overall process of data collection and information dissemination. When it is appropriate, EMS partners should get back street level information that could affect their performance and help keep EMS team members safe. This is a new model and provides a higher level of information exchange than has occurred in the past between EMS and law enforcement. While many EMS systems currently work closely with law enforcement on an incident-by-incident basis, rarely do these agencies share information to this level and degree as is being discussed. Of course, law enforcement is generally heavily involved in fusion center activities.

What is being proposed here is to include EMS agencies to a level that is appropriate; so that information flows in and out of fusion centers and that the entire process is enhanced. This exchange of information could be a win for both fusion centers and EMS. Providing a closer working relationship between EMS and fusion centers will improve information received by fusion centers and potentially could save lives or reduce injury, if EMS personnel and agencies are informed of terrorist trends and potential dangers due to terrorism. In general, working closely with fusion centers can also improve response in natural disasters and provide a better coordination of resources in day-to-day emergencies and processes. If a terrorist threat involves chemical, biological,

or nuclear issues, EMS and the rest of the healthcare establishment will be heavily involved. Having this process of information exchange will enhance EMS response, hospital care, and the fusion centers ability to provide timely and helpful information to reduce mortality and morbidity.

Fusion centers are a vital part of information sharing and analysis and the inclusion of EMS data will only enhance their ability to provide good solid information in a timely manner. Benefits to both EMS and fusion centers could be achieved with this total back and forth sending of pertinent information. All parties could benefit greatly by increased awareness of terrorist activities and warnings of possible hazards for EMS personnel in the field. Costs would be minimal for this process, since basically there will need to be a process and a reporting system. Some training will need to occur both for EMS personnel and fusion center personnel to enact the information flow. Initial and ongoing training will need to be established to keep all personnel up to date on fusion center processes. Also, policies may need to be changed to reflect inclusion of EMS in the processes and what role they will play. A quality improvement system should be established to measure effectiveness and to look for areas of improvement in the process. Benefits to the system can be documented by the amount of information exchanged and by determining the level of importance of the contribution of EMS data and data provided by fusion centers. Surveys of both EMS and fusion center personnel should be conducted to gauge the effectiveness of data collection and possible improvements in the system.

V. ANALYSIS AND EVALUATION—EMS RESPONSE TO DISASTERS

Traditional EMS response for over 40 years has not changed significantly from the "You call, we haul" mentality of the 60s. EMS is largely based on the normal process of one patient requiring help and placing a call to 911 with an ambulance response and sometimes a first responder response simultaneously. The patient is seen, treated, and transported and then the unit gets ready for the next call in the system. While call volume varies based on time of day and day of the week, this pattern of one patient, one ambulance fit the model of most EMS systems, regardless of who is providing the service. Models of this system vary to some degree based on a geographic deployment model, a dynamic deployment model, or one that combines the two.

Geographic models deploy EMS assets in fixed locations, so that as an ambulance responds and completes calls, they usually go back to the same location each time. These fixed locations look mainly at geographic modeling rather than populations or call volumes. Most of these systems deploy assets 24-hours a day throughout the year in the same pattern regardless of call volume or demand. Dynamic deployment models[77] utilize past EMS call data to determine or predict how many calls will occur based on the time of day and day of the week. They are usually electronic computer based and the software looks for patterns in call volume and time of day to determine the number of ambulances that are needed in a given hour and where they should be placed, regardless of geographic facilities or boundaries. Still other agencies utilize a combination of these two methods based on population needs and resource availability. Many times the efficiencies utilized to provide prehospital services in an economical manner builds in self organized criticality[78] and serves to make the system less responsive in a disaster situation. How

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[77] "Dynamic System Status Management," High Performance EMS, http://hpems.wordpress.com/2011/08/08/dynamic-system-status-management/ (accessed December 28, 2012).

[78] P. Bak, C. Tang, and K. Wiesenfeld, "Self-Organized Criticality," *Physical Review A* 38, no. 1 (1988), 364–374.

EMS assets are utilized in disasters has not been studied to any large extent. Traditional response in disasters does not meet the demand in most cases and additional methods of response need to be considered.

Depending on the type of disaster that presents itself, different models of ambulance response may need to be considered to meet needs and to reduce morbidity and mortality among the population affected by the disaster. New response models are being utilized in limited applications in specific areas, but no universally accepted new forms of response are recognized across the discipline. New and innovative response models need to be developed to determine where EMS expertise will augment current teams and enhance response. EMS could expand their current core role as EMS providers to work together to respond in ambulance strike teams and with other teams, such as law enforcement strike teams after disasters to provide real value where they are needed. EMS personnel provide the medical field expertise to keep specialized teams and communities safe. Personnel could provide specific expertise that would enhance response in many ways providing valuable medical support.

A.   AMBULANCE STRIKE TEAMS

One proposed method of providing EMS services outside of traditional response is with ambulance strike teams.[79] This approach combines regional assets of different EMS components to create a cohesive critical mass of EMS assets under the direction of a trained EMS commander to meet surge capacity for specific periods of time after a disaster. When a disaster strikes, many times EMS assets and personnel are compromised and demand far exceeds resources that are available. Even in large metropolitan areas, EMS assets can be limited and additional ambulances and personnel must be brought to bear on the situation to mitigate the circumstances. An EMS strike team of five ambulances with a strike team leader and sufficient supplies and equipment to last independently for days could provide focused, specific help where help is needed the most. Pairing this strike team with local resources for direction, coordination, and

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[79] *Ambulance Strike Teams/Medical Task Forces (AST) Guidelines* (Sacramento, CA: State of California, Emergency Medical Service Authority, 2003).

problem solving could work well to provide relief to local EMS teams and to increase the number of resources available on a temporary basis to meet the demands. These ambulance strike teams could be trained to cross county, regional, and state boundaries so that jurisdictional control becomes meaningless. Since these teams would deploy self sufficient in every way, the team would not be pulling from already scarce resources in the affected community. The number of deployed strike teams depends on the magnitude of the event, and the deployed teams are received from areas that have not been directly affected by the disaster event.

Best practice would be a network of strike teams that would be neighbor helping neighbor across all jurisdictional boundaries. The ambulance strike team can go into a disaster area and take the place of the affected EMS system or can augment a system that is overwhelmed. The strike team response can be scalable and several ambulance strike teams can be coordinated in one area depending on the need and area to be covered. Ambulance strike teams must come with sufficient medical equipment and food and supplies, so that the strike team is totally self-sufficient and does not present a drain on a current lack of resources after a disaster. The team must be able to coordinate with local medical facilities to meet the patient needs and have common protocols that apply to all strike team members. These strike teams can be a combination of several different EMS agencies from a region that act as one entity to respond in disaster situations. Teams should be coordinated through state and local emergency management, so that precise needs are met and no undue burden is placed on the already stretched resources. Strike teams can be ramped up or scaled down as the situation dictates and teams can be rotated in two-week increments, if the need for ambulance strike teams exists for an extended period of time.

This model of response is similar to current mutual aid agreements between EMS agencies; however, this requires more training and provides a highly coordinated machine instead of just plugging an ambulance in here and there into a disaster. To make this system work, there needs to be preplanning on the part of state and local agencies to determine who can participate in an ambulance strike team effort. Training for strike

team members would be minimal, probably 8–16 hours in length. Training for strike team leaders would be more extensive, probably around 40 hours. A state would need to coordinate strike teams over a regional basis, so that no matter where a disaster occurs, a strike team is close to respond with others backing them up from adjacent regions. Ambulance strike teams can be set up with little effort and with minimal training.

These teams will enhance homeland security efforts and improve EMS response in disaster areas. Costs for training and deployment could be reimbursed to local agencies from FEMA funds, especially response when these resources have been tracked and approved after a national disaster declaration. Since equipment and personnel are being utilized that already exist, costs should be low for initial response. Costs can also be contained by use of adjacent EMS resources for strike teams, so that teams are not traveling great distances. A network of ambulance strike teams across the nation would provide much needed backup from time to time and surge capacity for most EMS systems. Costs that would need to be reimbursed would be wages, disposable equipment that is used, and food and supplies to sustain the strike team during their deployment. One other cost would be to fund debriefing costs associated with teams after they complete their deployment. Working in post disaster areas can produce stress and taking care of the responders is important and necessary.

Measurement of the effectiveness of ambulance strike teams would be straightforward by evaluating the number of patients seen and how emergency situations were mitigated. In addition, measurements should be made to look at time for strike teams to assemble and respond and the number of strike teams required based on their effectiveness. Specific data related to strike team response, patients seen, types of medical issues responded to, and any other interventions related to the disaster should be collected. Comparative analysis could also be made in conjunction with other types of strike teams that respond to disasters. Comparisons with law enforcement strike teams, fire department strike teams, urban search and rescue teams, and other responders could be beneficial to determine ambulance strike team effectiveness.

B.   INCLUSION OF EMS IN LAW ENFORCEMENT STRIKE TEAMS

Another type of nontraditional participation is EMS personnel inclusion in law enforcement strike teams. The concept of law enforcement strike teams is similar to EMS strike teams; however, in this team, the idea is to include an EMS component in the law enforcement strike team. When a group of law enforcement officers have been assembled and are responding to a post disaster situation, they frequently encounter ill and injured citizens who are beyond their scope of training. Including EMS personnel with active law enforcement strike teams provides instant access to medical care and evaluation. This helps free up officers to do the job they were brought to do and provides a level of expertise that may not be readily available after a disaster. In addition to participating in patrol types of activities, frequently it helps to have EMS personnel at law enforcement camps for strike teams because frequently ill or injured citizens will make their way to such a camp knowing that potential help is there. Having a medical component on site at the law enforcement camps provides more capability and the availability to evaluate a situation quickly and efficiently. All of these circumstances occur in an environment where normal medical service and response has been compromised and medical services may not be readily available.

The inclusion of EMS in these strike teams not only assists officers and citizens in the manner described, but also lessens the burden of ill and injured people on a system that is already not functioning at normal standards. After a disaster, it is common for law enforcement to find injured or ill citizens, and since EMS services are not fully operational, it is helpful to get a medical evaluation of the patient immediately. The paramedic can facilitate treatment and transport decisions. This is helpful for law enforcement when on patrol and when they are in camps. Citizens will self evacuate to known law enforcement camps with a variety of issues including medical. On scene paramedics can provide care and help officers decide how to approach medical issues with citizens. In addition, when law enforcement strike teams are deployed, the officers themselves often develop medical issues of one type or another. While away and in unfamiliar territory, officers can become ill or injured themselves. A paramedic presence

can help treat officers on scene and provide a portal to a physician if necessary when specific protocols are in place. Having the capability to have instant medical evaluation and possible treatment provides a level of comfort to officers in the field and could provide the means of placing officers back in service quicker. With paramedic training, protocols, and equipment, EMS personnel can evaluate officers and treat as necessary to keep them healthy and in the field during their rotation as a strike team member. This process requires little training for the paramedics and some coordination with a medical director to determine appropriate diagnostic equipment and protocols for disaster management. Coordinating these issues ahead of time will facilitate the establishment of a system of deployment and identification of paramedics that will receive training for this type of mission.

Costs are very low for adding a paramedic to this team and benefits to officers are very high. This type of coordinated effort also provides a platform for continued cooperation between the disciplines of EMS and law enforcement. An understanding of capabilities and a willingness to work together toward a common mission is beneficial for all involved. One specific drawback in this model is the possible safety issues for paramedics in the field. After a disaster, there is the potential for lawlessness and crime. Paramedics need to receive specific training and possibly bullet proof vests to protect themselves as they operate in this environment. The safety of paramedics must be attended to just as the safety of police officers. EMS personnel must understand the inherent risks of working in post disaster conditions.

Adding EMS personnel to law enforcement strike teams could be evaluated and measured by surveying current law enforcement strike teams that do not have EMS involvement and then survey them again after EMS involvement. Specific determinations could be identified that would demonstrate the strengths and weaknesses of adding EMS personnel to these teams in the field. Many law enforcement agencies probably have not considered using EMS personnel on these teams before, and some may need to understand the potential value that EMS personnel can provide.

C.   INCLUSION OF EMS IN MULTIDISCIPLINARY TASK FORCES

One other method of response after a disaster is for EMS to participate in multi-disciplinary task forces that do not fit traditional models. Either before a known disaster strikes, such as a hurricane, or after a disaster has occurred, a multi-disciplinary task force could be assembled whose configuration varies based on the disaster type and the current need. The idea of the multi-disciplinary task force is to respond in pods and be self contained from the aspect of each discipline represented, so that each need is met as necessary. Each multi-disciplinary task force would be composed based on the specific need of that particular jurisdiction and type of disaster. One other model of possible EMS response is in preplaced multi-discipline task forces. These teams can be configured based on the disaster type that confronts the responders. A typical team configuration would consist of EMS, law enforcement, fire department, public works, and utility workers to deal with a multitude of problems from various locations throughout the affected areas.

When a disaster, such a hurricane is anticipated, these task forces can be prepositioned in target hardened areas that are in the communities that they serve. Rather than being centrally located, these task forces would be spread out across the community in safe locations until the storm or event has passed. Once it is safe after a storm to begin to respond, these task forces would work together to take action based on whatever types of disaster damage and injuries that have occurred. Public works would cut trees and clear roads, utility workers would handle electrical downed lines and deal with gas leaks, fire would provide rescue and access to trapped victims, EMS would treat and transport injured patients, law enforcement would provide protection to the task force and deal with crime and looters. All of these task force members would support each other and provide whatever services were necessary at the time to deal with the emergency at hand. With different task forces spread out in the community, the idea would be for each task force to work outward in their area until they meet other teams to handle the emergencies in each area. Each task force member would work within their discipline; however, each task force member would support their other task force members as needed. Task force

members would need to be preidentified and some training should be provided to each to work in a team. Supplies would need to be provided to the task force to remain self sufficient in a remote area.

Locations would need to be carefully determined, so that task force members would remain safe during and after the storm or event. It would need to be recognized that these task forces could be cut off for a period of hours, so their training and supplies would need to sustain them during this possible cut off period. Several methods of communication would need to be engaged, so that each task force and task force member could contact help if needed and request backup if needed. Specific polices and protocols would need to be developed before these task forces are deployed so that everyone understands their role and how each task force member functions. Effective multi-disciplinary task forces would provide immediate help to citizens in their areas and help to begin providing recovery for the community as a whole.

This type of task force configuration would need to be evaluated for specific role effectiveness and each task force member must be ready to multi-task when necessary to meet mission goals and not always act within the scope of their specific discipline. Some cross training on specific issues would be beneficial, and everyone working as a team would improve the effectiveness of the task force and mitigate circumstances quicker. These types of task forces and configuration of task forces should constantly be evaluated to be sure that each of these teams has all the necessary skills to survive and meet the needs of citizens after a disaster. This task force process would be new to most task force members, so some team training would be preferable to be sure everyone understands their specific roles and responsibilities, and so task force members would also understand where they can support one another to improve response.

Multi-disciplinary task force response could be evaluated in a similar fashion to other strike teams. Tracking of responses, trees cleared, power lines restored, injuries and illnesses treated, fires and rescues, arrests and assistance provided, and other interventions of the task force would be tracked and documented. Overall, the process of recovery immediately after a disaster would improve, as each of these multi-disciplinary

task forces move out in concentric circles from their established base area and connect with other task forces to open up roads, re-establish power and water, provide rescue and medical treatment, and return a state of normal flow of traffic and life in general to the area. Evaluation of these teams would need to be studied to determine the best indicators of effectiveness.

Costs of initial teams would be minimal, since all team members would be pulled from current resources and staged within their communities. Some or all of the costs of these teams could be reimbursed through federal funds after a disaster has been officially declared. Some training would need to be provided to all team members, so that they learn to function as a team and support one another's needs. Costs would consist of supplies for as long as the task force is expected to be activated to sustain task force members and get the mission accomplished. This may include communications and interoperability equipment to connect the task force to central dispatch and all logistical needs for their deployment.

D. TELEMEDICINE IN DISASTERS

New technology enables EMS to provide medical care in new response modes also in disasters. With limited resources at clinics and hospitals after a disaster, the question is where do patients go to receive adequate medical help? Many physicians' offices could be closed and access to other medical facilities will be limited with a potential surge of ill or injured citizens due to the disaster event itself. One answer could be to utilize technology to better direct the flow of patients and to possibly treat patients in the field without a trip to the hospital. This could be accomplished through telemedicine[80] and other remote medical technologies using EMS personnel as the hands and eyes of the physician. Telemedicine is a promising new technology that allows trained medics to provide a complete assessment and some treatment with physician involvement via a remote telemedicine access. With proper training and equipment, paramedics can bring physicians to scenes using telemedicine devices. This new

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[80] Xiong et al., *Implementing Telemedicine in Medical Emergency Response: Concept of Operation for a Regional Telemedicine Hub*, 1651–1660.

technology allows physicians to see individual patients while the paramedic in the field acts as the hands, eyes, and coordinator of the patient physical exam and treatment of the patient. Using video, audio, digital tools, such as digital otoscopes, stethoscopes, and spirometers, paramedics can provide direct patient contact with a physician on the other end of the line to provide a complete evaluation and possible diagnosis.

Medics will make contact with patients and those where is it not indicated that immediate ambulance transport is necessary to a hospital emergency room, those patients could bear further evaluation and treatment on the scene by a physician with the assistance of the medic on the scene. With digital technology, medics can provide remote access to physicians to patients by video camera, voice, digital instruments, such as otoscopes, stethoscopes, and Doppler technology.[81] In addition, digital x-ray, rapid blood testing, and other diagnostics can be performed by the medic on scene with results provided almost instantly to the physician on the other end of the line. Other testing equipment, such as mobile ultrasound or mobile x-ray could be utilized and digital results sent to the physician on the other end of the line. All of this would provide great benefits to patients in finding immediate results for diagnosis of complaints, and this could direct treatment, so that all patients are diagnosed and treated in an acceptable manner that is directed by a physician. Patients could be handled in appropriate ways that do not include the hospital if their condition warranted it.

Paramedics could be trained to provide minor suturing of wounds and treatment of specific conditions at the direction of the physician online. After initial assessment, physicians could direct the medic to provide specific treatments, decide to ask for transport of the patient, or direct the patient to seek care at other community facilities other than the crowded hospital.[82] This technology is already beginning to be used internationally for treatment of patients in remote areas of the world. This technology

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[81] Curt Bashford, "Virtual Care," EMS World, http://www.emsworld.com/article/10347432/virtual-care (accessed December 28, 2012).

[82] P. A. Haskins, D. G. Ellis, and J. Mayrose, "Predicted Utilization of Emergency Medical Services Telemedicine in Decreasing Ambulance Transports," *Prehospital Emergency Care* 6, no. 4 (2002), 445–448.

could work well in the disaster setting where medical resources are stretched and transport to medical care is limited.[83] How EMS could utilize telemedicine in disasters is an area that should be explored and practical applications should be made to mitigate medical issues after a disaster. Also, how telemedicine will connect in times of disaster when communication may be damaged, and there are limited connections, needs to be explored.

This system would have several costs associated with it; however, the potential of cost savings to the system is also very high. Telemedicine equipment would need to be purchased, and much training for paramedics and physicians on the use of the equipment, its capabilities and limitations, would need to be established. Significant training of paramedics would need to be accomplished, since this model would include new techniques not currently utilized by paramedics in the field today. Dependable communication devices would need to be purchased to connect the physician with the paramedic and patient in the field.

New protocols and policies would need to be developed to cover paramedic assessment and treatment with this new equipment. Also, state statutes and regulations would need to be reviewed to see if any adjustments would need to be made to recognize this treatment model and allow each of the treatment techniques by paramedics with physician direction. Finally, this assessment and treatment model must be integrated into emergency response plans, since this comprises a completely different approach than is currently established. This model of remote treatment currently exists utilizing telemedicine in medical mission work across the globe. Mission workers in remote areas currently consult via telemedicine with physicians to treat people based on their protocols and capabilities. This model would work for disasters also. Disaster application of telemedicine could be compared to current models that are used in medical missions today. While this type of application is slightly different, comparisons and measurements

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[83] N. K. Manchanda and S. D. Behera, eds., *Telemedicine—Role in EMS and Disaster Management* Alpha Science International Limited, 2003), 290.

could be compared between mission models and disaster models. A metrics must be developed to measure telemedicine to determine effectiveness.

E.   ADDITIONAL TRAINING NEEDS

All of these new response modes or combinations of them will require additional training for EMS personnel. Specific EMS strike team training and strike team leader training is necessary for units to function as desired. Training is needed for law enforcement and EMS in integrating EMS personnel into current law enforcement strike teams. Also, all disciplines need to be trained in multi-disciplinary teams, so that all team members understand their role and how to support one another in the team. Since it has been shown that EMS may be particularly vulnerable in respect to treating patients in specialty situations, such as in rural areas and with pediatric patients, specialized training needs to be provided for all medics to serve these specialized patients in these specific areas. In addition, since EMS personnel are not well versed in violent situations, chemical, biological, nuclear, and radiological response, more training is needed in each of these areas, so that EMS personnel are more comfortable treating patients in these situations and specialized equipment is needed to protect EMS responders and improve patient outcomes in these situations.

VI.   ANALYSIS AND EVALUATION—EMS ROLE IN RECOVERY

EMS roles in recovery after a disaster are not well defined. Most activities related to the disaster diminish for EMS except for injury and illness caused from cleanup efforts and from post disaster disease. EMS operations move back to a normal state long before the community has recovered and gone back to normal themselves. There are potential roles that EMS personnel could take on that could help speed the recovery of the community and utilize the special training and talents of EMS personnel. Recovery has not historically included EMS personnel, but EMS personnel have specific skill sets, such as training in safety evaluation that would be particularly helpful in most recovery efforts, and EMS personnel are not currently in an active recovery role. This recovery step would utilize valuable personnel with unique skill sets not in use today. EMS personnel could receive specific focused training to participate in disaster recovery and mitigation efforts. EMS personnel could be part of disaster assessment teams, clinic response, and field immunization efforts to reduce disease after disasters and to speed recovery efforts in communities.

The role of EMS in recovery efforts is not defined in most cases. EMS continues to provide traditional response and transport before, during, and after a disaster event. When the demand for EMS services diminishes after a disaster event has occurred, EMS personnel are usually underutilized, since their primary role of response and transport has ended. With the skills and training of EMS personnel, an expanded role in recovery efforts could speed up recovery efforts of a community and EMS personnel could provide new services that they currently do not provide. After a disaster, EMS returns to normal EMS response, however, the community has not returned to normal, as a matter of fact the community is far from normal. The skills of EMS personnel could provide avenues for the community to return to normal quicker.

## A.	USE OF EMS PERSONNEL IN NONTRADITIONAL ROLES IN RECOVERY

First is the use of EMS personnel in nontraditional roles. After disasters, there are many issues to be resolved; however, there are never enough personnel to handle many aspects of the recovery. Most professional personnel like EMS are placed in silos and only work within their particular discipline at all times. There are many functions within a community that just need people, regardless of what their specialty is or how they were trained. EMS personnel could possibly be funneled into some of these recovery roles when they are not needed exclusively for EMS response. Being flexible is key to moving forward after a disaster event, and EMS personnel taking on nontraditional roles could help recovery efforts for the entire community.

## B.	INCLUSION OF EMS IN POST DISASTER ASSESSMENT TEAMS

Another possible role for EMS personnel after a disaster is as part of a disaster assessment team. EMS personnel are already trained to look for dangers and safety issues in their line of work. With their medical training, they could add a strong medical component to current damage assessment teams. If citizens with illness or injury are found during the damage assessments, EMS personnel would be there to treat and call for transport as needed. In addition, their unique safety training, such as identification of hazards and identification of mechanism of injury, could be an asset to damage assessment teams providing a medical component to their efforts. Some training would need to be provided to EMS personnel in damage assessment, but this would be minimal. Medical protocol and equipment would be identical to what EMS personnel currently utilize in the field, so there would be no additional costs. Rapid, accurate assessment of damage, including medical needs and medical safety issues need to be incorporated into damage assessment teams to expand the capabilities of these teams, to more accurately assess damage, and to prevent further injury and illness in a recovery phase.

Currently, fire personnel are usually included in damage assessment teams. This fire model could provide the basis for EMS inclusion also. EMS personnel are well trained in recognition of safety issues and hazards associated with physical structures and

those associated with illness and disease. The observation skills of EMS personnel could augment disaster assessment teams and not only structural damage could be assessed, but also the living conditions of victims and possible injuries or disease processes that are still present. These issues that have not been addressed during the disaster could be assessed by EMS personnel, and they could provide guidance on how to resolve these issues with community resources. Instant evaluation, treatment, and recommendations could be provided to citizens, thus speeding up recovery one person at a time as they are encountered. With trained personnel shortages after a disaster, EMS personnel could augment current damage assessment teams and provide this valuable input. Some additional training would be advised for EMS personnel to understand how to adapt their current skill set to this new task.

C. EMS PERSONNEL PROVIDING ASSISTANCE AT MEDICAL FACILITIES

Another potential area of EMS involvement in recovery efforts would be in providing additional resources where they are needed in various medical facilities. EMS personnel could assist and augment personnel in local clinics, hospitals, or other medical facilities, if they are overloaded with patients and need additional staffing. As patients move through the recovery effort, their needs may change, and they may not need emergency services in the recovery phase but still need certain medical care. EMS personnel could adapt to provide specific assistance to patients that would increase capabilities in various medical facilities to improve efficiencies and ease the load on those individual staffs. Some additional training of EMS personnel may be required and some specific allowances in state laws may need to be addressed to allow EMS personnel to assist in post disaster situations within these various types of medical institutions.

D. IMMUNIZATIONS AND COMMUNITY MINI CLINICS

One other area of possible EMS assistance after a disaster has impacted an area is by providing various types of immunizations to the public as needed depending on circumstances. This model of preventive care already exists in many areas of the country.

After the H1N1[84] outbreak of 2008, many EMS services provided this service to their community, usually partnering with local public health agencies to provide manpower and expertise in outlying areas of the community. Since EMS has trained personnel and ambulances that can serve as quasi mobile clinics, EMS was selected in many areas to provide immunizations to the community that would not normally have healthcare readily available to them.

This concept of mobile healthcare could be applied to many situations, especially when paired with the concept of telemedicine as was previously discussed. Depending on the situation and needs of the population, a combination of mobile clinics on ambulances with a telemedicine component could assist greatly in the medical recovery of underserved citizens that are in need. After a disaster event, many people in economically challenged and remote communities may not be able to access appropriate healthcare. EMS personnel could reach out to these people and provide minor medical care and medical assessment. People could be referred to more definitive care when it is indicated, and it is possible to utilize telemedicine at these locations, as was described in a previous section of this thesis. Mobile medical outreach could prevent more severe disease and could attend to minor medical problems before they worsen. As part of this mobile care, paramedics could offer targeted immunizations that otherwise might not be given because people do not have transportation or connections with the established medical community. This outreach could meet medical needs and improve recovery efforts while saving resources at hospitals and emergency rooms. Benefits from this process would be great and very little would need to be provided in the way of training or equipment to EMS, unless telemedicine was utilized. As was discussed earlier, if telemedicine is used, there is a much greater level of cost and training that must be provided. Outside of telemedicine, however, except for immunization training, there is little that needs to be added to a paramedics set of tools and training.

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[84] "H1N1," U.S. Department of Health and Human Services, http://www.flu.gov/about_the_flu/h1n1/index.html# (accessed December 29, 2012).

E.   MEASURING EFFECTIVENESS

Measurement of the effectiveness of post disaster teams could be evaluated by counting the number of patients seen, measuring what types of issues paramedics contacted, counting immunizations, and looking at other encounters that could affect recovery. A main measure of effectiveness would be how many patients seen by EMS crews would not have received medical care of immunizations if EMS had not responded into the community to take care of patients after a disaster. Analysis of types of encounters must be evaluated in context of what issues were handled that would not have been taken care of with conventional services that are always available. EMS could provide services in remote or affected areas after a disaster that normal public health or hospitals cannot access.

Finding nontraditional roles for EMS to play after a disaster has passed during recovery could put these personnel to work and provide a quicker road to recovery for the entire community. Expanding their responsibilities after a disaster will provide more value to the EMS system and to the citizens who they serve.

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VII. ANALYSIS AND EVALUATION—EMS DATA AND SYNDROMIC SURVEILLANCE

One other area that holds great promise for the area of homeland security is in utilizing EMS data in early warning of possible terrorist activity through syndromic surveillance. Syndromic surveillance is defined by the Centers for Disease Control (CDC) as a system that improves early detection of outbreaks attributable to biological terrorism or other causes.[85] Currently, there are many areas where syndromic surveillance is being used. EMS data, however, is not widely used today in most systems and in monitoring EMS dispatch data and run reporting data, there is the possibility of receiving medical data much faster than in current systems that depend on respective analysis of emergency room, hospital, or public health data. Specific EMS data has the potential to be the tip of the spear in identifying the beginning of a terrorist attack or a naturally occurring illness process.

Monitoring EMS dispatch and run reporting data could provide very early indicators of a potential terrorist threat or natural disaster especially that is chemical, biological, or radiological in nature. An unusual group of medical symptoms within specified time parameters could indicate abnormalities that need to be investigated with a homeland security view. EMS dispatch and run reporting data could be utilized to help indicate potential threats from terrorists and from naturally occurring healthcare pandemics in real time. Aberrant sets of data could be an early warning sign of a spreading disease or poisoning event in a city, region, or state. Data that falls outside normal patterns could indicate a threat that needed to be addressed to mitigate outcomes for victims. Since EMS data is early on in the process, this data could indicate what potential issues exist—but could trigger more false positives. More study needs to establish what data elements should be monitored and what threshold triggers are most effective and accurate to correctly identify terrorism or naturally occurring hazardous

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[85] Henning, *What is Syndromic Surveillance?*, 7–11.

events. All EMS data should be also looked at in conjunction with health department and hospital data to improve accuracy and effectiveness.

A.   CURRENT USES OF SYNDROMIC SURVEILLANCE

Current uses of syndromic surveillance data consists of retrospective analysis of data from hospitals, health departments, and other health establishments that leads to indicators of disease processes and issues, however, while providing good information, it does not allow real-time responses to ongoing outbreaks of naturally occurring disease processes or terrorist attacks. An example of a current syndromic surveillance system is the Center for Disease Control's (CDC) Early Recognition and Deterrence System (EARS).[86] This system collects information from hospital emergency room data and looks for patterns of disease and diagnosis in treatment. While providing great data, it is voluntary and provides data after a diagnosis has been made by a doctor, and the paperwork has been electronically filed with the CDC. This process works great for identification of issues and future planning, however it provides little in the way of indicators of a disease process in real time and does not provide the opportunity to respond and mitigate the situation as it develops.

New technologies have provided the tools to begin to look at syndromic surveillance data in real time.[87] When specific parameters have been preidentified and normal levels of those parameters have been studied and selected within a system, it begins to become clear when abnormalities occur and to look for reasons why and to seek solutions to mitigate the problem.[88] Identifying several parameters of medical symptoms that could indicate a naturally occurring disease process or a terrorist attack or patterns of

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[86] Benjamin L. Hegler and David A. Dunfee, "Biological Terrorism Preparedness: Evaluating the Performance of the Early Aberration Reporting System (EARS) Syndromic Surveillance Algorithms," (Master's Degree in Applied Sciences, Naval Postgraduate School), 1–123.

[87] Roberts, *Tracking Infectious Disease with EMS Agency Real-Time System Data*, 1–16.

[88] K. D. Zamba, Panagiotis Tsiamyrtzis and Douglas M. Hawkins, "A Sequential Bayesian Control Model for Influenza-Like Illnesses and Early Detection of Intentional Outbreaks," *Quality Engineering* 20, no. 4 (October, 2008), 495–507.

symptoms could provide the opportunity to monitor these parameters and look for abnormally high spikes in activity that could indicate problems.[89]

B.   THE SYNDROMIC SURVEILLANCE PROCESS

Identification of potential problems is the first step in taking appropriate action. When the preidentified parameters are selected for monitoring, then normal patterns of these parameters must be established. A historical evaluation of these parameters in the past will yield normal levels that are acceptable for each of the parameters. Once the norm has been identified, it becomes easier to set alarms for when levels of activity is above normal levels. This set of abnormal levels of activity could provide a warning of a sentinel event that needs to be evaluated and could indicate that actions need to be taken to mitigate the ongoing situation.[90]

Once abnormal levels have triggered a warning, it then must be determined who will be notified and what their next step will be. Probably the person notified will need to evaluate the information provided by the new technology to verify that an abnormal spike has occurred and then determine what steps need to be taken, if any, to resolve the situation. Prearranged actions would need to be defined based on the threat level and type of incident that presents itself. Protocols that would identify who should be notified at what level, what resources need to be activated, how serious is the threat, and should the general public be advised of the ongoing issue should all be in place and ready to initiate. Specific people and resources need to be predetermined that would respond to different types of incidents and provide expertise and the ability to mitigate serious incidents. This system has the potential to react quickly to threats and to diminish the negative impact of detrimental events and to diminish morbidity, mortality and property damage.

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[89] Ross Sparks et al., "Understanding Sources of Variation in Syndromic Surveillance for Early Warning of Natural or Intentional Disease Outbreaks," *IIE Transactions* 42, no. 9 (September, 2010), 613–631.

[90] Galit Shmueli and Howard Burkom, "Statistical Challenges Facing Early Outbreak Detection in Biosurveillance," *Technometrics* 52, no. 1 (February, 2010), 39–51.

In addition, this technology has the potential to provide a psychological advantage to be ahead of the event and to provide life saving and public calming information to agencies and the public that could give the general public the feeling of security by knowing that events can be detected early and appropriate actions taken to reduce death and injury.

C. NEW TECHNOLOGY

New technologies also help provide opportunities that were not available in the past. New software provides these new opportunities to collect and quickly analyze data that is being generated by EMS dispatch centers and EMS units in the field. This type of analysis is new and provides access to data in real time that has never been available before, thus, additional processes and protocols must be developed to deal with this data and what conclusions can be made from this data.
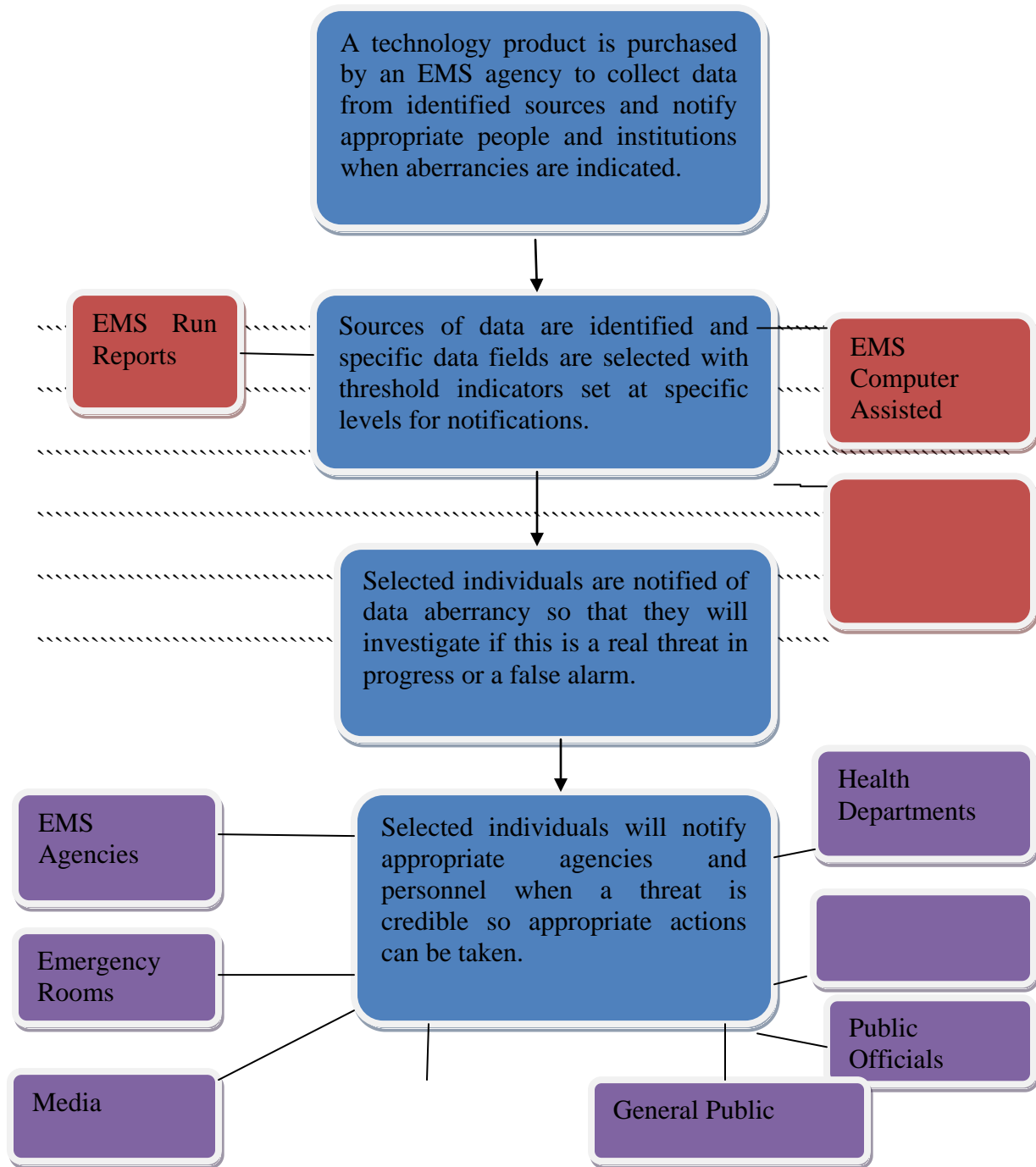
Figure 1.   Overview of How Syndromic Surveillance Technology Works in EMS

This new data requires a different model than is currently in use, even by those that utilize syndromic surveillance today. These new processes must cover everything from collection to analysis to actions that are taken as a result of data that is discovered. Data collected needs to reflect specific symptoms that patient's exhibit once exposed to a chemical, biological, nuclear, or explosive attack. These symptoms can range from fever to changes in vital signs. Specific parameters need to be established to determine normal ranges of these symptoms and what levels of aberration to note as something that exceeds normal limits and is worthy of monitoring. Once these data points are selected and normal levels are determined, then determining what levels of aberration is unacceptable provides a threshold for taking some type of action that is necessary. This may vary based on the parameter being looked at, and it may vary based on what combination of data presents itself. Fever alone may not indicate a potential event; however, fever combined with nausea, vomiting, and other similar symptoms may indicate an attack of some kind. These sets of symptoms deserve to be studied further to determine the right set of symptoms and what combinations provide the best indicators of terrorist or naturally occurring events.

D.   WHAT SHOULD BE COLLECTED

Data at this time should be collected from EMS computer assisted dispatch (CAD) records and from electronic run reporting systems. These electronic systems that are many times connected to networks wirelessly can in combination with the syndromic surveillance software constantly monitor the data in the background without anyone watching or aware of its presence. This combination of tools could possibly predict an event long before any human could. These data sources do contain much confidential medical information that is protected by federal and state law; however, the aggregate data that is being collected for syndromic surveillance does not expose any individual patient to a breech in their data. This aggregate collection of data would be anonymous, and no individual patient data would be exposed even to those who review the syndromic surveillance data and take actions based on that data. In the future, it is possible that other

sources of data could be evaluated to be included in syndromic surveillance. Anything that can be tracked electronically could be included, based on the value of the information.

E.   HOW DATA IS ANALYZED

Once a data system for syndromic surveillance is established and data elements have been selected, it is now time to determine what level of each data element is within a normal pattern. Data elements must be evaluated individually over a historic time period to see what a normal range is for each data set based on time of year, day of the week, time of day, and other parameters that can cause changes in data elements. Other issues that could cause changes in data include population changes, special events, temporary population shifts, seasonal illness, change of the season, special populations, and other things that specifically impact each data element. Looking at all these potential issues that cause changes is vital to the process because understanding the normal patterns of each data element is critical in order to set thresholds later that indicate abnormalities.

Once normal levels of data points have been determined, it is then necessary to try to find what is abnormal for that particular data point and where the level needs to be placed for a threshold that would trigger a notification for that event. This step is critical to the process because events should not be missed; however, it is best to minimize false positives, so that notifications of possible terrorist or naturally occurring events only happen when it is within reason. Too many false positives, or too many misses of events, could render the entire system useless and without value. This is a balancing act with data that is worthy of further investigations and study. More research, specifically regarding EMS data and what it indicates needs to be implemented and benchmarks need to be established. Everything from which data points are worthy of being collected and at what level of aberration that these data points are valuable in identifying possible threats is necessary to establish and set up as a national standard. Once this information has been established, it could then be established which other databases or disciplines could benefit from this information. EMS data could be linked with hospital or local health

department data that combined would strengthen pattern recognition and lead to a more complete picture of the possible threat. This abnormal point in the data determines when a notification needs to be sent out. This notification is for someone to take a look at the data to observe just why the data is abnormal. It is possible that sometimes there is a plausible explanation for why data is at aberrant levels? It is possible that no actions need to be taken. However, it is important that whoever is notified by the syndromic surveillance system fully understands the system and what explanations there could be for the aberrations in the data.

So, a careful process needs to be in place to find the right person to notify and to train them on what protocols to follow and when to make further notifications, if an event presents itself. Sometimes one individual will not have all the answers. From time to time, this data may need to be analyzed by a group of individuals, such as those at a fusion center to determine what the data is stating. These connections between EMS and fusion centers must be predetermined and a process for data to flow must be established well ahead of time of any event. The notification process should be set up like a tree, depending on what the data indicates and what agencies are responsible for responding to each type of incident. Certain sets of patient symptoms may need to be evaluated by chemical experts and physicians to try to isolate a particular compound that individuals may have been exposed to. Or biologists and epidemiologists may need to look at possible biological toxins that are suspected in an event. These experts must be available when needed must be able to provide timely evaluation of the data and have access to other data sources when a suspected incident has been discovered. In other words, simply collecting data is not enough, careful and thoughtful evaluation and analysis of the data by experts is necessary to be sure that an event is occurring and to determine a correct course of action.

F.   WHAT ACTIONS NEED TO BE TAKEN?

This of course leads to what actions need to be taken in this continuous decision tree or process that leads to mitigation of an ongoing threat. Once again, specific, predetermined possible actions need to be thought out and possible responders to events

need to be selected and available for each type of emergency that presents itself. Decisions about if and when to notify the general public of an event, what actions the general public should take, and what level of panic will result must all be taken into account. Benefits and costs of mitigating an actual event versus costs and issues created by false notifications must also be evaluated. The important thing is to have a protocol on all aspects of syndromic surveillance from initial notification parameters to what final actions will be taken by those who are notified.

Syndromic surveillance has great potential to quickly identify possible terrorist or naturally occurring medical events and will allow authorities to take actions early that could mitigate circumstances and could possibly limit mortality, morbidity, and property damage. Syndromic surveillance is one important piece of an entire puzzle when an ongoing event is unfolding. Adding this early warning sign could point the way to look ahead to other data that would verify a developing event and allow appropriate action to be taken.

There would be some costs to deploying syndromic surveillance software on EMS CAD and run reporting systems. There could be economies of scale as more and more EMS systems invest in this technology. Also, since there are so many benefits to so many different agencies, such as law enforcement, public health, hospitals, fusion centers and others from this data, sharing the cost of this software only makes sense. Aggregated EMS data combined with other clues can help paint a clearer picture and allow appropriate agencies to respond to prevent or mitigate circumstances as indicated. This proposed model simply updates and speeds up current thinking and theories on syndromic surveillance. Other CDC and hospital models of syndromic surveillance can be applied and compared to an EMS model, only the data sources are slightly different, and the results are obtained quicker. Because of this rapid access to data indicators, timely assessment of data must be made and correct actions must be taken as a result of review of the data.

Measurement of the success of syndromic surveillance has been well documented in the past with traditional systems. This new model of syndromic surveillance will need

to be researched and studied to be sure that good data is being collected, pertinent data points have been identified, normal levels of that data have been determined, correct thresholds have been identified to trip a notification, and that the appropriate person has been notified when aberrancies in the data have been detected. In addition, sound protocols must be applied to indicate what actions need to be taken and at what level. False positives must be avoided as much as possible, and thresholds must be set properly to be sure that suspected incidents do not go unnoticed. Over or under triage of these events could have negative results and must be avoided.
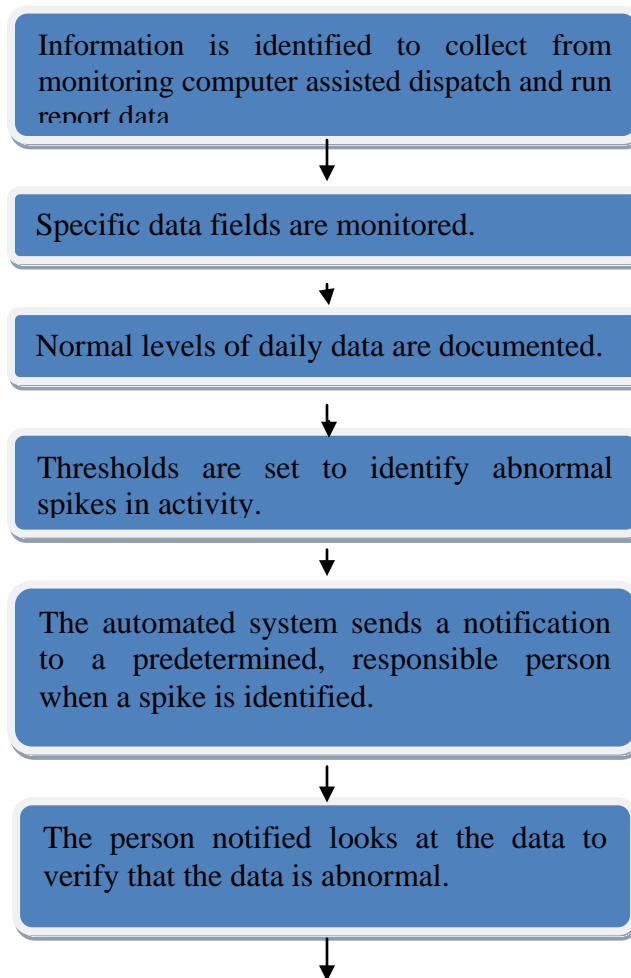

Figure 2.　How an Incident is Collected and Reported in Syndromic Surveillance

VIII. FINDINGS AND DISCUSSION

Overall improvements in these five areas related to EMS and the homeland security enterprise provides great opportunities to improve many areas of homeland security and to expand the capabilities of EMS as a discipline. Integration of EMS as a full partner, working together side by side with common goals and clearly identified objectives improves the overall approach to U.S. homeland security issues and provides EMS with the opportunity to expand in healthy and beneficial ways for the communities they serve, and the U.S. as a whole. These proposed improvements provide opportunities and could provide information and capabilities that would diminish or stop a terrorist attack or certainly mitigate the circumstances after an attack occurred. While all of these potential improvements would be beneficial on some level, connecting EMS personnel with fusion centers including use of EMS personnel as intelligence sensors and also EMS data in syndromic surveillance hold the most promise of enhancement to homeland security. With the correct triggers, EMS data could provide indicators of unusual activities that could provide early indicators of potential problems. Implementation of these areas associated with EMS would enhance capabilities for EMS and for homeland security in important aspects that has the potential to positively impact the overall picture of security here at home.

Putting these new processes into practice will require different approaches and strategies for each process discussed in this thesis. Each one is unique and has its own challenges to implement and will have its own proponents and opposition. Some of these new processes have models that can be emulated from other disciplines while others are new and will need to be piloted and studied to define best practices.

A. RESPONSE

An ambulance strike team is a concept that is being used in specific areas that regularly experience natural disasters of some type. California and Florida use the concept of strike teams within their own state to respond to hurricanes, earthquakes, and

wildfires. The models currently being utilized by both are simple in nature and generally follow a pattern of five ambulances with a strike team leader and supplies to sustain the team for a specific period of time. Most other areas do not use this model and very few use this model outside of their own state.

The current models that are being used should be studied to determine what practices work best and this model should be adopted on a national basis to respond to both natural and manmade disasters. Agreements must be in place between states to allow strike teams to cross state lines when necessary and to allow personnel that are licensed in one state to practice in disaster situations in another state. Memorandums of understanding (MOUs) must be in place and coordinated by DHS before disaster strikes and training should be provided to all EMS agencies that participate. The federal government under the Federal Emergency Management Agency (FEMA) is using this concept partially in that they have hired a contract private ambulance firm to provide ambulances wherever needed after a disaster. This model is good; however, neighbor helping neighbor across the nation would be a better overall model to follow that would allow quick response from local agencies that are familiar with protocols, equipment, and processes in their local regions when they respond.

There are concerns with the current model that FEMA uses with contracting a private ambulance firm, such as if ambulances would be pulled from local systems without notification in a manner that could affect local operations and also of the continued viability of one single private ambulance provider. These concerns should be addressed with local EMS regulatory agencies on future contracts. FEMA should also provide coordination for a nationwide network of EMS strike teams that could respond in any direction to a region that is negatively affected adjacent to them. This could potentially provide rapid and effective backup response to the entire country with enough participation. Providing assistance to neighbors in their time of need should be a responsibility of every EMS agency. Participating in this type of model would provide an expectation of both response and help when a disaster affects your agency. Response by strike teams would be metered to match the level of disaster, and the need of the local

areas that were affected by the disaster. This use of current resources is economical and primarily needs coordination by DHS to make this process a reality.

To implement this process, FEMA should be lobbied to study the models of California and Florida, and they should begin putting a plan together to create a process that includes all states and crosses all jurisdictions. Sample MOUs should be adopted and training should be standardized so that all regions are covered using the same standards and processes that can be adapted to every state and area. FEMA should not mandate that this process take place, but rather should encourage participation and provide incentives for those that do participate, such as grant funding for training and placing protocols into action. Creating a model and establishing it in pilot programs that are funded through grants would encourage states to adopt this process and create a network of EMS strike teams across the nation. Funding should be provided to strike teams when activated by FEMA when a disaster is declared.

Promoting EMS in law enforcement strike teams could start locally from agencies that have begun this process and work from models that have been successful. Standards for implementation need to be developed and made available to EMS agencies and law enforcement agencies across the nation. These standards must include protocols to keep EMS personnel safe, provide law enforcement real value in the field during a disaster, and to allow local medical directors the ability to provide medical direction to EMS personnel when they are in remote areas after a disaster has passed. Some EMS agencies may oppose this process, since it is nontraditional and may place personnel at some risk during a response. This is why safety issues must be addressed, such as bulletproof vests and safety training for EMS personnel in working with law enforcement. Team building and practice for response would enhance both EMS and law enforcement personnel response by understanding roles and how each other functions and how each discipline could support the other. Law enforcement agencies need to understand the benefits of this model, and articles in law enforcement journals need to be published to promote this design.

Multi-discipline task forces of responders could provide a great advantage in disasters that are known to be developing and when time is available for task forces to be assembled and deployed. Multi-disciplinary task forces are generally local agency personnel that will respond immediately after a disaster. While this is a local process, a national or state standard of who should be on the task force, what each task force members role is, and training standards to produce an effective and efficient task force could be produced to facilitate this program.

A model that could be designed and researched would go a long way toward providing a basis for local agencies to implement this design, and this process would also provide a model of cooperation between many local agencies that may not exist at the current time. These task forces would need to find appropriate, safe locations, so that during the active phase of the disaster all task force members would be safe, and all vehicles and equipment would be available to respond immediately when it was safe to do so. This type of response model would need to be incorporated into local emergency management plans, so that task force members and responsibilities would be spelled out, equipment could be designated for support, and all roles and responsibilities of task force members would be clearly understood. Specific training on team building, cooperation and some cross training, so that task force members could back each other up would need to be provided. Practice through drills would be indicated to allow task force members to improve processes and learn to work with one another during disaster situations. Multi-disciplinary task forces of responders could prove to be a valuable tool in responding to a disaster situation and is a unique opportunity for EMS to participate in another innovative manner.

Telemedicine is a growing field, and it is currently being studied to provide a different approach within a Community Paramedic concept for EMS. This approach would allow EMS personnel to contact physicians directly with video, audio, digital instruments, and other diagnostic processes to allow direct intervention by a physician with patients. While telemedicine is being used globally in many types of medical mission work, its use to expand local EMS issues is in its infancy. A natural adaptation of

this process would be to add it to a disaster response. Whether a disaster is a natural or manmade disaster, having direct physician involvement via telemedicine could meet the immediate need of patients in the field and lessen the load of patients that flood emergency rooms. Comparisons should be made with medical mission work that is currently going on to measure their successes and evaluate how to adapt the technology to function in a disaster situation and provide tangible results. Once this comparison is complete, a pilot project with a local EMS agency should be undertaken to provide the equipment and training necessary to initiate this process. This process should be funded through a DHS grant program. To be as practical as possible, a disaster telemedicine project should probably be combined with a Community Paramedic project, so that the cost of the equipment is broadened, so the equipment and training are for multiple uses. Providing equipment and training, and then waiting for a disaster to occur, may not be practical.

Once a pilot project is underway, study and research must be conducted to determine the best approaches with the right equipment and the correct set of referrals. In this process, for maximum effect, patients would need to be referred to medical help other than emergency rooms, which is where most people go today. Many medical issues, particularly minor ones, could probably be treated more effectively, quicker, and with less cost at medical facilities other than hospital emergency rooms. With direct physician intervention and specific diagnostic testing, patients could safely be referred to clinics, physician's offices, and other medical facilities that could adequately meet their needs and help the community recover quicker. This process would require EMS systems to maintain a list of medical facilities and physicians that would be open and available after a disaster. This process involves the entire local medical community, not just EMS systems and hospitals.

EMS personnel would need to receive training and protocols related to what patients would be appropriate candidates for a telemedicine intervention and which patients still need direct transport to a hospital. The pilot project for this program would best be suited to be funded by a grant, either from the federal government or a private

69

agency that is interested in improving disaster response and better patient flow after disasters. This model of using telemedicine has the potential to improve patient outcomes and provide real cost savings in the disaster recovery effort.

B.   RECOVERY

Once a disaster has passed, many times EMS systems move fairly quickly back to a normal pattern of operation. While there are post-disaster injuries from debris removal and electrical repairs, most EMS systems' patterns of call volume returns to normal. After most disasters, it takes the community weeks, months, or years to fully recover. EMS personnel could go outside their traditional role of simply providing first response and transport to assist the community in its recovery efforts.

One potential new role of EMS personnel after a disaster would be to provide medical care in ambulances or other vehicles to function as mini-clinics in the most remote or most affected areas where medical care is not readily available. Many times people in severely affected areas after a disaster do not have transportation or feel that there are more pressing priorities than taking care of their health. EMS systems could provide ambulances with additional equipment to set up local clinics where privacy is maintained inside the ambulance; however, the medical help is in the patient's backyard. This process could be combined with either additional personnel, such as local health department nurses and physicians, or it would work well with a telemedicine project as was described earlier. Paramedics could receive special training and follow specific protocols to deal on the spot with minor suturing, evaluation of minor illnesses, and also provide immunizations if they were indicated based on need after the disaster. This is medical care that patients may not receive after a disaster unless it is conveniently available locally in their immediate community. Dealing with medical issues early, before they become critical, will lead to improved outcomes overall for patients, lower costs due to early intervention, and less stress on the healthcare system, since there will be fewer patients in already overcrowded emergency rooms. This type of EMS outreach could provide many beneficial results to improve ties with local communities and provide real health improvements for the community at large.

This process could begin with a pilot project, so that results and best practices could be established and findings evaluated to determine what interventions, post disaster are most beneficial. Again, as with the telemedicine project, patients could be referred when necessary to other available medical resources within the community. These links would provide a stronger network between patients in underserved communities and local medical clinics and physicians to improve the health of a community and to build trust. Again, EMS must take the lead in these efforts, since they are the ones with mobile resources, and they are familiar with their local communities and know where such interventions would be most effective. A national or state model could be developed to begin implementation of this type of post disaster response. Costs would be low, since most personnel and equipment would already exist with local EMS systems and local health systems. Some training would need to be provided to educate EMS personnel on how to deal with nonemergent issues, and where to refer patients that need follow-up.

One other potential area of EMS involvement is in support of disaster assessment teams in post disaster situations. EMS personnel have unique training that would compliment current teams to expand and improve assessment of safety and potential medical complications. Having this emergency medical perspective on disaster assessment would provide a more rapid measurement of the post disaster situation and have the potential to improve recovery efforts, if medical aspects and safety are taken into account. Another advantage of EMS involvement in this process is immediate medical assessment of people that may not realize that they need medical intervention. A rapid health assessment of people encountered could allow EMS personnel to treat minor conditions or refer patients to local medical resources that would meet their needs before complications occur.

Again, early intervention can prevent more serious conditions, alleviate suffering, and lower cost. EMS personnel have been trained to look for unsafe situations and size them up quickly in addition to their emergency medical training. These combined skills could augment disaster assessment teams to provide a medical and safety perspective that does not exist on all teams now. This process should begin with a measurement of what

71

disaster assessment teams currently look like across jurisdictions. Determinations should be made to look at gaps and to see if a medical and safety perspective will enhance current team configurations. After a disaster, many unanticipated situations present themselves. The need for rapid medical and safety assessment is essential for individuals and businesses to determine how to move forward after an event. The special skills and training of EMS personnel could contribute to these recovery efforts, particularly after the main demand for EMS services has passed after a disaster. Once gaps in assessment teams have been determined, trained paramedics should be added to teams and provided with specific functions to contribute. This process could begin as a pilot project and then be studied to determine the results.

C. INTELLIGENCE SENSORS

EMS personnel functioning as intelligence sensors must be implemented on a local, agency by agency basis, however, federal agencies, such as the Department of Homeland Security (DHS) should provide EMS agencies nationwide with standards and training to begin to move forward on this issue. Beginning locally through fusion centers would be a great place to start. What terrorist traits to look for are common across agencies and jurisdictions and training for EMS personnel could be standardized. This development of standards and training could provide the impetus for local agencies to adopt these standards and provide training. Grants from DHS could facilitate this training by establishing train the trainer programs in each state. With a common curriculum and common standards, implementation would be easier, and terms could be common between agencies and fusion centers.

The Arizona Counter Terrorism Information Center (ACTIC)[91] provides training currently for all first responders. Their training for EMS personnel in identification of terrorists and terrorism is identical to that of law enforcement. This standard approach ensures that everyone is speaking the same language and that all agencies, regardless of discipline, will respond in a similar fashion that is recommended. This focused and equal

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[91] "Arizona Counter Terrorism Information Center," Arizona Counter Terrorism Information Center, http://www.azactic.gov/Community_Liaison/ (accessed December 28, 2012).

response is critical to the success of any intelligence program. EMS being equal partners in providing intelligence will lend respect and full participation in fusion center operations and help keep EMS personnel safe by providing prevention when terrorism is identified. Fusion centers should adopt standards for EMS and other first responders, such as the ACTIC, and begin training of those responders for inclusion in their data process.

D.   FUSION CENTERS

EMS involvement in fusion centers parallels their involvement in intelligence gathering. These two efforts must be conjoined to be totally effective. The flow of information in and out of fusion centers is an essential part of establishing EMS personnel as intelligence sensors. EMS personnel and agencies must feel that they are a fully functioning part of the intelligence process, and that they are receiving necessary information back to keep personnel safe in the field in order to provide intelligence to the process. This total circle of information sharing can provide real benefits to both EMS and to the fusion center. This model of information sharing, once established, can then be transferred to other entities, such as hospital and public health personnel.

A cohesive community approach to terrorist information would benefit the entire population and possibly stop or mitigate a terrorist event. Part of this evaluation process would be the medical analysis of information provided by medical sources. Understanding medical terminology and processes is essential to analyzing intelligence that comes from medical sources. Fusion centers must have the capabilities to analyze data from an EMS and health department perspective, especially when terrorist threats involve chemical or biological components. EMS personnel could assist in the analysis of this data in fusion centers to help provide a clearer picture of what information has been provided. Creating and providing a document that demonstrates the advantages of including EMS as a partner in fusion centers could be developed and sent out to fusion centers. This would help promote inclusion and provide best practices for each fusion center. Fusion centers should contact EMS and other health related agencies in their jurisdiction to establish sound connections for data flow and training. Fusion centers must

take the lead on creating a stream of information in and out of the center that augments current efforts and allows analysis of EMS data by trained professionals that understand medical terminology and medical implications. Training should be offered to EMS personnel and other healthcare providers in identification of terrorists and information processes of the fusion center.

E.   SYNDROMIC SURVEILLANCE

Syndromic surveillance holds great promise in possibly detecting terrorist threats early before any conventional method. EMS data in particular could indicate a threat earlier than any other data that is available today. While new advances in technology allow the monitoring of data in innovative ways, standards are yet to be developed that would indicate what specific parameters would provide the best indicators of possible terrorist attacks. Studies and research are indicated to determine what specific data elements or combinations of data elements would provide the best clues to provide early warning and to alert appropriate authorities to look at ongoing data. This standardization of data elements should be coordinated by the Centers for Disease Control (CDC), DHS, and national EMS entities. Providing standards would go a long way toward establishing EMS syndromic surveillance as an important part of early warning systems and allow for a common measured response. Common standards would need to include what data elements to collect, what are normal levels of activity for each data element, what threshold needs to be reached for an abnormal level of activity to sound a warning, and who should be notified at each level of activation. Once all of this has been established, it must be determined how the data will be analyzed and then, most importantly, what actions are appropriate to be taken.

Once all these standards have been established, grants from DHS should be created to allow EMS agencies to purchase software that will connect with their EMS dispatching and run reporting systems. This would encourage EMS systems to adopt this new technology and to connect with other agencies to be part of an intelligence network connected to local fusion centers. All of this data would need to be coordinated with the CDC, DHS, fusion centers, local health departments, local emergency management

offices, and possibly local law enforcement and state emergency management. Ongoing monitoring of data and results must continue to be sure that the best data is obtained and the best results achieved.

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IX.   RECOMMENDATIONS AND CONCLUSIONS

Change is the law of life. Those who look only to the past or the present are certain to miss the future. – John F. Kennedy

What are the arguments for and against EMS involvement in intelligence gathering, fusion centers, expanded models of response, expanded models of recovery, and use of EMS data in syndromic surveillance to enhance homeland security?

A.   RECOMMENDATIONS

The overall recommendations of this thesis fall into four main categories.

1.   Measurement

EMS and DHS should work together to create measurement tools and matrices that gauge EMS preparedness and response capabilities for a variety of disasters and circumstances that exceed normal daily operations. These tools must measure effectiveness of the EMS system as a whole and point to positive patient outcomes. Specific variations in the tools need to take into account the differences in EMS systems, such as urban and rural aspects, however, these measurements should become a national benchmark for evaluating EMS systems and providing suggestions on how to improve performance and improve patient outcomes. Tools such as these can provide data for grant submissions and approval, specific equipment recommendations, and optimal levels of personnel and training. Without a measurement tool of some kind, EMS has no way of comparison between systems and cannot know where improvements need to be made in their systems.

2.   Data

Data from EMS can be utilized in homeland security issues in many ways. Connecting data to state and national databases has already begun; however, none of the data is currently used for homeland security purposes. Specific EMS data could be reviewed and collected by fusion centers. Part of the collection could come from EMS

personnel themselves when they observe possible terrorist activities in the normal course of their duties. Creating the mechanism for data flow and training EMS personnel in what terrorist issues to look for are vital. In addition, analysis of this data must include a medical component so that symptoms and medical references can receive adequate evaluation and so that data can be placed in the proper place during an inquiry. In addition, EMS data could provide valuable early warning alerts of either terrorist or naturally occurring events that could indicate a real threat. Early warning of events through EMS data collection could provide the time needed to mitigate or prevent an event from occurring.

3. Training and Education

EMS personnel need more training and education in the area of homeland security. Today EMS personnel receive little in the way of homeland security awareness, threats to national security, or how to respond when terrorist events occur. EMS personnel need a greater overall understanding of what threats exist and how to identify those threats when they encounter them in their jobs. This training could help prevent attacks certainly; however, it could also prove to provide a level of safety for EMS personnel in the field simply by understanding what could hurt them if not identified properly. Additional training in the areas of identification of terrorist threats, how to report terrorist activities, what actions to take and what actions not to take when threats are identified, and how to respond effectively and safely to disaster types of events is needed. In addition, some extra training may need to be provided to specific responders, if they take on new roles that have been discussed in this thesis. This training would be targeted and specific to the roles that each medic would take on as the situation dictates.

4. Research

EMS is a relatively young profession and not much research has been performed on how it functions and what really makes a positive difference in the lives of the people EMS serves. How EMS responds and functions has remained basically the same since its beginning. What is needed is research into new and innovative ways to respond and

integrate into existing structures to enhance capabilities and improve outcomes for patients and citizens. EMS should explore new roles, including those that accentuate homeland security. These roles include use of EMS personnel as intelligence sensors to improve national security. It also includes new models of response and recovery to enhance effectiveness, improve efficiencies, improve patient outcomes, and meet the needs of disaster victims. This research must link with current medical entities, such as hospitals, public health, physicians, and others within the medical community to create systems that meet benchmarks and national guidelines. In addition, EMS should partner with other first response agencies and others in the community to create a total response metrics that meets the needs of disaster victims and helps enhance overall security goals of the United States. Finally, research is needed in the area of EMS and syndromic surveillance. Research needs to discover the effectiveness of early warning parameters and which parameters provide valuable indicators of threats. Also, such research must determine threshold levels, best notification practices, and what responses are necessary to mitigate incidents in real time. Research is necessary to prove the value of EMS involvement and to guide steps to take to do what is needed to bolster the efforts of EMS and to create an effective workforce for homeland security.

With these simple, yet valuable recommendations, EMS can move toward a more cohesive alignment with nontraditional roles and provide real value where it naturally fits. With careful evaluation, new roles and missions for EMS can provide amplified efforts in homeland security and also provide new opportunities that do not exist today. EMS can be a valuable and important partner in the fight against homeland terrorist threats and in naturally occurring disasters.

B.   CONCLUSION

Take time to deliberate; but when the time for action arrives, stop thinking and go in – Andrew Jackson

EMS is a critical part of disaster planning, response, recovery, and more; however, EMS has not been an active partner in homeland security in years past. It is time for EMS to integrate and expand roles across the homeland security spectrum.

Finding logical extensions of EMS duties that fit into the homeland security picture can enhance capabilities and improve response to citizens. EMS is an existing workforce that needs to exceed their current grasp to provide real value and enhance their own profession. Through appropriate research and evaluation, new roles and responsibilities can be established and funding sources can be identified to meet goals and objectives of expansion. Expansion of EMS roles in homeland security is a win for both EMS and U.S. homeland security.

APPENDIX. TABLE OF SPECIFIC RECOMMENDATIONS

EMS as Intelligence Sensors

Provide training to EMS personnel in trait based identification of terrorists and terrorist activities.
Treat the intelligence sensor process in a prevention model type.
Elevate terrorism reporting to mandatory reporting status for EMS personnel.
Train EMS personnel to maintain HIPAA and state confidentiality of patient information especially during reporting activities.
Keep EMS reporting focused on terrorist activities, not on any other type of general crime.

Fusion Center Participation of EMS

Provide a reporting mechanism for EMS personnel to report terrorist activities to fusion centers.
Provide training to EMS personnel on how to report and to fusion center personnel on how to utilize EMS data.
Allow for a mechanism for fusion centers to appropriately analyze EMS and medical data.
Have fusion centers provide appropriate information and intelligence back to EMS field personnel to keep them safe and informed.

EMS Response to Disasters

Ambulance strike teams should be developed on a local basis across the nation with national coordination of local assistance of these teams.
Measurement tools must be developed to gauge EMS effectiveness in disasters taking in to account urban and rural systems and specialty populations that are served.
EMS personnel should be included as a part of law enforcement strike teams.

EMS personnel should be included in multi-disciplinary disaster response teams.
EMS should utilize telemedicine in disaster response with direct physician intervention.
Research should be conducted into what new models of disaster response for EMS is effective.

EMS Role in Recovery

Include EMS personnel in post disaster assessment teams.
Have EMS personnel assist at community medical facilities to enhance recovery efforts of the community.
Coordinate EMS in setting up post disaster community mini-clinics that would provide follow-up care and needed immunizations in underserved areas.
Research should be conducted on how EMS can contribute to recovery efforts after a disaster.

EMS Data and Syndromic Surveillance

EMS dispatch and run report data should be utilized in syndromic surveillance networks to allow early detection of terrorist or naturally occurring events.
Research should be conducted to determine what data should be monitored that provides the earliest and most reliable indicators of an aberrant event that indicates a possible terrorist or naturally occurring event.
Research must be conducted on what actions are necessary to mitigate a terrorist or naturally occurring event once one has been identified.
New technologies need to be analyzed to determine which ones work best for early warning in syndromic surveillance.
Benchmarks must be developed to indicate normal patterns of symptoms and what levels constitute an aberrant level that indicate a terrorist or naturally occurring event.

BIBLIOGRAPHY

Alexander, Yonah. *Terrorism and Medical Responses: U.S. Lessons and Policy Implications*, edited by Alexander, Yonah, Stephen D. Prior. New York, NY: Ardsley, 2001.

Ambulance Strike Teams/Medical Task Forces (AST) Guidelines. Sacramento, CA: State of California, Emergency Medical Service Authority, 2003.

"Arizona Counter Terrorism Information Center." Arizona Counter Terrorism Information Center, accessed December 28, 2012, http://www.azactic.gov/Community_Liaison/.

Bak, P., C. Tang, and K. Wiesenfeld. "Self-Organized Criticality." *Physical Review A* 38, no. 1 (1988): 364–374.

Banschbach, David C. "Optimizing Systems of Threshold Detection Sensors." Master's in Operations Research, Naval Postgraduate School, Monterey, CA, 2008.

Barbera, Joseph A., Anthony G. Macintyre, and Craig A. DeAtley. *Ambulance to Nowhere: America's Critical Shortfall in Medical Preparedness for Catastrophic Terrorism*. Washington, D.: George Washington University John F. Kennedy School of Government, 2001.

Bashford, Curt. "Virtual Care." EMS World, accessed December 28, 2012, http://www.emsworld.com/article/10347432/virtual-care.

Bassil, Kate L., PhD, MSc, Donald C. Cole, MD, Rahim Moineddin, Effie Gournis, Brian Schwartz, Alan M. Craig MSc, W. Y. Wendy Lou PhD, and Elizabeth Rea. "Development of a Surveillance Case Definition for Heat-Related Illness using 911 Medical Dispatch Data." *Canadian Journal of Public Health* 99, no. 4 (Jul/Aug 2008): 339–43.

Bennett, Gregory. *Cross-Training for First Responders*. Boca Raton, FL: Taylor and Francis, 2010.

Berne, Robert. *Emergency Medical Services: The Forgotten First Responder*. New York City, NY: New York University, Center for Catastrophe Preparedness and Response, 2005.

Bioterrorism: Public Health Response to Anthrax Incidents in 2001. Washington, D.C.: United States General Accounting Office, 2003.

Bongar, Bruce, Lisa M. Brown, Larry E. Beutler, James N. Breckenridge, and Philip G. Zimbardo. *Psychology of Terrorism*. New York: Oxford University Press, 2007.

Brown, Lawrence H., E. Brooke Lerner, Todd LeGassick, and Michael Taigman. "Are Ems Call Volume Predictions Based on Demand Pattern Analysis Accurate?" *Prehospital Emergency Care* 11, no. 2 (Apr–Jun 2007): 199–203.

Burke, Robert A. *Counter-Terrorism for Emergency Responders*. 2nd ed. Boca Raton, FL: Taylor and Francis, 2007.

Busko, Jonnathan. "EMS and Medical Surveillance." Elsiviere Publishing, accessed February 20, 2012, http://www.emsworld.com/article/10322103/ems-and-medical-surveillance.

Butler, Jay C. "Collaboration between Public Health and Law Enforcement: New Partnership for Bioterrorism Planning and Response." *Emerging Infections Diseases* 8, no. 10 (2002).

Cahill, Joseph C. "Symptom Surveillance." *Fire Chief* 49, no. 7 (Jul., 2005): 38–39.

Campbell, John and Jim Smith. *Homeland Security and Emergency Medical Response*. Boston, MA: McGraw Hill Higher Education, 2008.

Casavant, Marcel J. "Novel Surveillance System Analyzes Poison Control Calls for Public Health." Ohio State University, College of Medicine and Public Health, accessed August 30, 2012, http://www.docstoc.com/docs/43706513/NOVEL-SURVEILLANCE-SYSTEM-ANALYZES-POISON-CONTROL-CALLS-FOR-PUBLIC.

Catlett, Christina, J. Lee Jenkins, and Michael G. Millin. *Role of Emergency Medical Services in Disaster Response: Resource Document for the National Association of EMS Physicians Position Statement*. Philadelphia, PA: Prehospital Emergency Care: Official Journal of the National Association of EMS Physicians and the National Association of State EMS Directors, 2011.

Chapman, Wendy W., John N. Dowling, Atar Baer, David L. Buckeridge, Dennis Cochrane, Michael A. Conway, Peter Elkin, et al. "Developing Syndrome Definitions Based on Consensus and Current use." *Journal of the American Medical Informatics Association* 17, no. 5 (Sep., 2010): 595–601.

Child Welfare Information Gateway. "Mandatory Reporters of Child Abuse and Neglect: Summary of State Laws." U.S. Department of Health and Human Services, Administration for Children and Families, accessed January 16, 2013, https://www.childwelfare.gov/systemwide/laws_policies/statutes/manda.cfm.

Chin, Natasha. "Dr. James Buehler on the Promise of Syndromic Surveillance." *Homeland First Response* no. May/June 2004): 42–43.

Chretien, Jean-Paul, Nancy E. Tomich BS, Gaydos, Joel C., MD, MPH, and Kelley, Patrick W., MD, DrPH. "Real-Time Public Health Surveillance for Emergency Preparedness." *American Journal of Public Health* 99, no. 8 (Aug., 2009): 1360–3.

Coleman, C. Norman, and Nicole Lurie. "Emergency Medical Preparedness for Radiological/Nuclear Incidents in the United States." *Journal of Radiological Protection* 32, (2012): 27–32.

Committee on Trauma and Committee on Shock. "Accidental Death and Disability: The Neglected Disease of Modern Society." *The National Academy of Sciences* (July 1966): 1–44.

Crosse, Marcia. "National Preparedness: Improvements Needed for Acquiring Medical Countermeasures to Threats from Terrorism and Other Sources." *United States Government Accountability Office, Oct 2011, iii+52 Pp.* (Oct., 2011).

Cummings, Curtis E., and E. Sitkova. "Strengthening National Public Health Preparedness and Response to Chemical, Biological and Radiological Agent Threats." Skopje, Macedonia, NATO Advanced Study Institute on Strengthening National Public Health Preparedness and Response for Chemical, Biological, and Radiological Agents Threats, June 2006, 2007.

Currao, Thomas J. "New Role for Emergency Management: Fostering Trust to Enhance Collaboration in Complex Adaptive Emergency Response Systems." Master's in Security Studies, Naval Postgraduate School, Center for Homeland Defense and Security, 2009.

Dao, Jason H. "Assessing the Effectiveness of Biosurveillance Via Discrete Event Simulation." Master's in Operations Research, Naval Postgraduate School, 2011.

Donnelly, John A. "Effect of Assessment Processes on Measuring Homeland Security Capability." Master's in Security Studies, Naval Postgraduate School, 2007.

Dunfee, David A. "Biological Terrorism Preparedness: Evaluating the Performance of the Early Aberration Reporting System (EARS) Syndromic Surveillance Algorithms." Master's in Applied Science, Naval Postgraduate School, 2007.

Dunford, James, Robert M. Domeier, Thomas Blackwell, Gregory Mears, Jerry Overton, Edgardo J. Rivera-Rivera, and Robert Swor. "Performance Measurements in Emergency Medical Services." *Prehospital Emergency Care* 6, no. 1 (2002): 92–98.

El Emam, Khaled, Jun Hu, Jay Mercer, Liam Peyton, Murat Kantarcioglu, Bradley Malin, David Buckeridge, Saeed Samet, and Craig Earle. "A Secure Protocol for Protecting the Identity of Providers when Disclosing Data for Disease Surveillance." *Journal of the American Medical Informatics Association* 18, no. 3 (May, 2011): 212–217.

Elliott, Ross W. "Measuring Disaster Preparations of Local Emergency Medical Services Agencies." Master's in Security Studies, Naval Postgraduate School, 2010.

"Dynamic System Status Management." High Performance EMS, accessed December 28, 2012, http://hpems.wordpress.com/2011/08/08/dynamic-system-status-management/.

Emergency Medical Services at the Crossroads. Washington, D.C.: University of Virginia, 2006.

Emergency Medical Services Outcomes Evaluation. Washington, D.C.: United States National Highway Traffic Safety Administration, 2003.

"Evaluating the Utility of Syndromic Surveillance Algorithms for Screening to Detect Potentially Clonal Hospital Infection Outbreaks." *Journal of the American Medical Informatics Association* 18, no. 4 (07, 2011): 466–472.

Furbee, Paul, Jeffery Cohen, Sharon K. Smyth, William G. Manley, Daniel E. Summers, Nels D. Sanddal, Teri L. Sanddal, et al. "Realities of Rural Emergency Medical Services Disaster Preparedness." *Prehospital and Disaster Medicine* 21, no. 2 (2006): 64–70.

Garza, Alex, G. "Real Time EMS Events as Surrogate Events in Syndromic Surveillance." *Advances in Disease Surveillance Journal* 4, no. 7 (2007).

Greenko, Jane, Farzad Mostashari, and Annie Fine. "Clinical Evaluation of the Emergency Medical Services (EMS) Ambulance Dispatch-Based Syndromic Surveillance System, New York City." *Journal of Urban Health* Volume 80, no. Number 2, Supplement 1 (2003): 50–56.

Groenewold, Matthew Raymond. "Reliability and Validity of EMS Dispatch Code-Based Categorization of Emergency Patients for Syndromic Surveillance."

Haskins, P. A., D. G. Ellis, and J. Mayrose. "Predicted Utilization of Emergency Medical Services Telemedicine in Decreasing Ambulance Transports." *Prehospital Emergency Care* 6, no. 4 (2002): 445–448.

Hauenstein, Logan, Tia Gao, Tsz Wo Sze, David Crawford, Alex Alm, and David White. "A Cross Functional Service Oriented Architecture to Support Real Time Information Exchange in Emergency Medical Response." New York, NY, EMBS Annual International Conference, Aug 30-Sept 3, 2006.

"The Health Insurance Portability and Accountability Act of 1996." U.S. Department of Health and Human Services, accessed December 28, 2012, http://www.hhs.gov/ocr/privacy/.

"Healthcare Reform." U.S. Department of Health and Human Services, accessed December 28, 2012, http://www.healthcare.gov/.

Hegler, Benjamin L., and David A. Dunfee. "Biological Terrorism Preparedness: Evaluating the Performance of the Early Aberration Reporting System (EARS) Syndromic Surveillance Algorithms." Master's in Applied Sciences, Naval Postgraduate School, 2007.

Henning, Kelly J. *What is Syndromic Surveillance?* Atlanta, United States, Atlanta: U.S. Center for Disease Control, 2004.

Henretig, Fred. "Biological and Chemical Terrorism Defense, A View from the "Front Lines" of Public Health." *American Journal of Public Health* 91, no. 5 (May 2001).

Henry, Judy, Patrick Murphy, Janet Pichette, David Anderson, and Heather Cook-Sinclair. "Natural Disasters and use of Syndromic Surveillance: Austin, Texas Metro Area 2011." Atlanta, GA, Emerging Health Threats Journal, December 2011.

Henry, Vincent E., and Douglas H. King. "Improving Emergency Preparedness and Public-Safety Responses to Terrorism and Weapons of Mass Destruction." *Brief Treatment and Crisis Intervention* 4, no. 1 (Spring 2004): 11.

Holton, W. Conard. "Professionals Or Volunteers? that is the Question for Many Localities that must Contend with Providing Fire and Emergency Medical Services at a Time when Emergencies are Becoming More Diverse and Complicated." *Empire State Report* 17, no. 0747–0711 (June, 1991): 11–12.

"H1N1." U.S. Department of Health and Human Services, accessed December 29, 2012, http://www.flu.gov/about_the_flu/h1n1/index.html#.

Hripcsak, George, Nicholas D. Soulakis, L. I. Li, Frances P. Morrison, Albert M. Lai, Carol Friedman, Neil S. Calman, and Farzad Mostashari. "Syndromic Surveillance Using Ambulatory Electronic Health Records." *Journal of the American Medical Informatics Association* 16, no. 3 (May, 2009): 354–361.

Hu, Cecelia X. "A Comparative Analysis of Multivariate Statistical Detection Methods Applied to Syndromic Surveillance." Master's in Applied Science, Naval Postgraduate School, 2007.

"Injury Prevention - Bike Helmet Program." Santa Barbara County Emergency Medical Service Agency, accessed January 16, 2013, http://www.countyofsb.org/phd/ems.aspx?id=21844.

The Joint Advisory Committee on Communications Capabilities of Emergency Medical and Public Health Care Facilities. Washington, D.C.: United States Congress, 2008.

Jones, Dennis D. "Defining the Role and Responsibility of the Fire Service within Homeland Security." Master's in Security Studies, Naval Postgraduate School, 2010.

Khan, Ali S. "Public Health Preparedness and Response in the USA since 9/11: A National Health Security Imperative." *The Lancet* 378, no. 9794 (Sep 3–Sep 9, 2011): 953–956.

Kollek, Daniel, Michelle Welsford, and Karen Wanger. "Chemical, Biological, Radiological and Nuclear Preparedness Training for Emergency Medical Services Providers." *Canadian Journal of Emergency Medicine* 11, no. 4 (2009).

Kuisma, Markku, Teuvo Määttä, Taisto Hakala, Tommi Sivula, and Maria Nousila‑Wiik.

"Customer Satisfaction Measurement in Emergency Medical Services." *Academic Emergency Medicine* 10, no. 7 (2003): 812–815.

Kwok-Leung Tsui, Wenchi Chiu, Peter Gierlich, David Goldsman, Xuyuan Liu, and Thomas Maschek. "A Review of Healthcare, Public Health, and Syndromic Surveillance." *Quality Engineering* 20, no. 4 (Oct, 2008): 435–450.

LaTourrette, Tom. *Protecting Emergency Responders, Volume 2: Community Views of Safety and Health Risks and Personal Protection Needs*. Santa Monica, CA: Rand, 2003.

Leggiere, Phillip. "High Stakes Security." *HS Today* Volume 2, Number 6, no. June 2005 (2005): 29–39.

Levy, Barry S. *Terrorism and Public Health: A Balanced Approach to Strengthening Systems and Protecting People*, edited by Levy, Barry S., Victor W. Sidel. New York, NY: Oxford University Press, 2003.

Lister, Sarah A. *The Public Health and Medical Response to Disasters: Federal Authority and Funding*. CRS Report for Congress. United States Foreign Press Center, 2006.

Logsdon, Jasie K. "Biosurveillance Technology: Providing Situational Awareness through Increased Information Sharing." Master's in Security Studies, Naval Postgraduate School, Center for Homeland Security and Defense, 2011.

Manchanda, N. K., and S. D. Behera, eds. *Telemedicine—Role in EMS and Disaster Management*: Alpha Science International Limited, 2003.

Mann, Clay N. "Introduction to the National Emergency Medical Services Information System (NEMSIS) and Its Potential Use in Syndromic Surveillance." Atlanta, GA, International Society for Disease Surveillance, January 31, 2012.

Mears, Greg. "2011 National EMS Assessment." (2011): 90–1–550.

Memongkol, N., R. Sinthavalai, N. Seneeratanaprayune, W. Ounsaneha, and C. Choosuk. "Development of Performance Indicators in Operational Level for Pre-Hospital EMS in Thailand." *World Academy of Science, Engineering and Technology* 58, (2009).

Mims, Leeanna. "Improving Emergency Medical Services (EMS) in the United States through Improved and Centralized Federal Coordination." Master's in Security Studies, Naval Postgraduate School, Center for Homeland Security and Defense, 2011.

Moore, Kieran M., MD, Bronwen L. Edgar MHSc, and Donald McGuinness. "Implementation of an Automated, Real-Time Public Health Surveillance System Linking Emergency Departments and Health Units: Rationale and Methodology." *CJEM : Journal of the Canadian Association of Emergency Physicians* 10, no. 2 (Mar., 2008): 114–9.

Moore, Lori. "Measuring Quality and Effectiveness of Prehospital EMS." *Prehospital Emergency Care* 3, no. 4 (1999): 325–331.

Morrissey, James F. "Strategies for the Integration of Medical and Health Representation within Law Enforcement Intelligence Fusion Centers." Master's in Security Studies, Naval Postgraduate School, 2007.

National EMS Scope of Practice Model. Washington, D.C.: U.S. Department of Transportation, National Highway Traffic Safety Administration, 2007.

"National Highway Safety and Traffic Administration." U.S. Government, accessed December 28, 2012, http://www.nhtsa.gov/.

National Strategy for Biosurveillance. Washington, D.C.: The White House, 2012.

Nordin, James D., Sophie Kasimow, Mary Jeanne Levitt, and Michael J. Goodman. "Bioterrorism Surveillance and Privacy: Intersection of HIPAA, the Common Rule, and Public Health Law." *American Journal of Public Health* 98, no. 5 (May, 2008): 802–807.

"North Huntingdon EMS/Rescue Community Fall Prevention Program." North Huntingdon Township EMS/Rescue, accessed January 16, 2013, http://www.rescue8.org/fallprevention/.

Ostrow, Lauren Simon. "The Controversy Over EMS, Homeland Security and the Feds." *Best Practices in Emergency Services* 8, no. 6 (2005): 61–63.

Owens, J. C. "Emergency Medical Services (EMS) Communications: Conservation of Time." *IEEE Transactions on Vehicular Technology* 25, no. 4 (Nov., 1976): 161–167.

Pajonk, Frank-Gerald, Patrik Schmitt, Andreas Biedler, Jens Christian Richter, Wolfgang Meyer, Thomas Luiz, and Christian Madler. "Psychiatric Emergencies in Prehospital Emergency Medical Systems: A Prospective Comparison of Two Urban Settings." *General Hospital Psychiatry* 30, no. 4 (2008): 360–366.

Pavlin, Julie A. "Medical Surveillance for Biological Terrorism Agents." *Human and Ecological Risk Assessment* 11, no. 3 (Jun 2005): 525–537.

Pavlin, Julie A., Farzad Mostashari, Mark G. Kortepeter, and Noreen A. Hynes. "Innovative Surveillance Methods for Rapid Detection of Disease Outbreaks and Bioterrorism: Results of an Interagency Workshop on Health Indicator Surveillance." *American Journal of Public Health* 93, no. 8 (Aug., 2003): 1230–5.

Petrie, Michael. "The use of EMS Personnel as Intelligence Sensors: Critical Issues and Recommended Practices." *Homeland Security Affairs Journal* 3, no. 3 (September 2007).

Phelps, Scott. "Mission Failure: Emergency Medical Services Response to Chemical, Biological, Radiological, Nuclear, and Explosive Events." *Prehospital and Disaster Medicine* 22, no. 4 (July–August 2007).

Preparing for Terrorism: Tools for Evaluating Metropolitan Medical Response System Programs, edited by Institute of Medicine, Committee on Evaluation of the Metropolitan Medical Response Program E-Brary Electronic Book Collection, 2002. http://site.ebrary.com/lib/nps/Doc?id=10038539.

Public Health Surveillance using Emergency Medical Service Logs- U.S.-Mexico Land Border, El Paso, Texas, 2009. Washington, D.C.: Centers for Disease Control and Prevention, 2010.

Reilly, Michael J., David Markenson, and Charles DiMaggio. "Comfort Level of Emergency Medical Service Providers in Responding to Weapons of Mass Destruction Events: Impact of Training and Equipment." *Prehospital and Disaster Medicine* 22, no. 4 (July–August 2007).

Richardson, Thomas J. "Identifying Best Practices in the Dissemination of Intelligence to First Responders in the Fire and EMS Services." Master's in Security Studies, Naval Postgraduate School, 2010.

Roberts, Leonard. *Tracking Infectious Disease with EMS Agency Real-Time System Data*. Seattle, WA: Seattle Fire Department, 2010.

The Role of "Home" in Homeland Security: The Role of First Responders: The Challenge for State and Local Government. Symposium Ser. no. 4. Nelson A. Rockefeller Institute of Government, State University of New York, 2004.

Sayre, Michael R., Lynn J. White, Lawrence H. Brown, and Susan D. McHenry. "The National EMS Research Strategic Plan." *Prehospital Emergency Care* 9, no. 3 (2005): 255–266.

Scott, Greg. "Pandemic Flu and 9–1–1." *Emergency Number Publication Magazine* January/February, (2008):19–21.

Shapira, Shmuel C., Jeffrey S. Hammond, and Leonard A. Cole, eds. *Essentials of Terror Medicine*. New York, NY: Springer Science and Business Media, 2009.

Shemer, Joshua, and Yehuda Shoenfeld. *Terror and Medicine: Medical Aspects of Biological, Chemical, and Radiological Terrorism*. Lengerich, Germany: Pabst Science Publishers, 2003.

Sherner, Joshua. *Terror and Medicine: Medical Aspects of Biological, Chemical and Radiological Terrorism*. Lengerich, Germany: Pabst Science Publishers, 2003.

Shirm, Steve, Rebecca Liggin, Rhonda Dick, and James Graham. "Prehospital Preparedness for Pediatric Mass-Casualty Events." *Pediatrics; Official Journal of the American Academy of Pediatrics* 120, no. 4 (2007): 756–761.

Shmueli, Galit, and Howard Burkom. "Statistical Challenges Facing Early Outbreak Detection in Biosurveillance." *Techno metrics* 52, no. 1 (02, 2010): 39–51.

Simon, Lauren. "Swift, High-Tech Response Keeps EMS on Top of Swine Flu Outbreak." *Best Practices in Emergency Services* 12, no. 7 (July, 2009): 1–2.

Singley, S. J. "Failure to Report Suspected Child Abuse: Civil Liability of Mandated Reporters." *J.Juv.L.* 19, (1998): 236.

Smiley, Daniel R., Anna Loboda, Cheryl Starling, and Jeff Rubin. "Transformation from Planning to Operations: Emergency Medical Services in Disaster Response." *Annals of Disaster Medicine* 3, no. 1 (2004).

Sparks, Ross, Chris Carter, Petra Graham, David Muscatello, Tim Churches, Jill Kaldor, Robyn Turner, Wei Zheng, and Louise Ryan. "Understanding Sources of Variation in Syndromic Surveillance for Early Warning of Natural Or Intentional Disease Outbreaks." *IIE Transactions* 42, no. 9 (Sep., 2010): 613–631.

"START-National Consortium for the Study of Terrorism and Responses to Terrorism." National Consortium for the Study of Terrorism and Responses to Terrorism.

"State and Major Urban Centers Fusion Centers." U.S. Department of Homeland Security, accessed December 28, 2012, http://www.dhs.gov/state-and-major-urban-area-fusion-centers.

Stout, Todd. "Data, Fusion, and the 911 Center." *Emergency Number Professional Magazine* no. May, 2005 (2004).

Subbarao, Italo: et al. "A Consensus-Based Educational Framework and Competency Set for the Discipline of Disaster Medicine and Public Health Preparedness." *Disaster Medicine and Public Health Preparedness* 2, no. 1 (2008): 57–68.

"Success with Car Seat Check." Durham County Emergency Medical Services, accessed January 16, 2013, http://dconc.gov/index.aspx?page=163&redirect=1.

Syndromic Surveillance: An Effective Tool for Detecting Bioterrorism? Santa Monica, CA: RAND, Health Programs, Center for Domestic and International Health Security, 2004.

Tierney, Kathleen J. "Emergency Medical Preparedness and Response in Disasters: The Need for Interorganizational Coordination." *Public Administration Review* 45, no. , Special Issue: Emergency Management: A Challenge for Public Administration (Jan., 1985): 77–84.

Uhde, Kristin Broome. "Bioterrorism Syndromic Surveillance: A Dual-use Approach with Direct Application to the Detection of Infectious Disease Outbreaks."

United States. Congress. House. Committee on Governmental Reform. Subcommittee on National Security, Veterans Affairs, and International Relations. *Homeland Security: Keeping First Responders First: Hearing, July 30, 2002.* Hundred and Seventh Congress sess., 2003.

Wang, Hui, Wei Xiong, Nathaniel Hupert, Christian Sandrock, Javeed Siddiqui, and Aaron Bair. "Concept of Operations for a Regional Telemedicine Hub to Improve Medical Emergency Response." Austin, TX, Winter Simulation Conference, 2009.

Weber, James S. "Are You Embracing the New Frontier in Lifesaving?" Cygnus Business Media, accessed December 28, 2012, http://www.emsworld.com/article/10319741/are-you-embracing-the-new-frontier-in-lifesaving.

Xiong, Wei, Aaron Bair, Christian Sandrock, Sophia Wang, Javeed Siddiqui, and Nathaniel Hupert. "Implementing Telemedicine in Medical Emergency Response: Concept of Operation for a Regional Telemedicine Hub." *Journal of Medical Systems* 36, no. 3 (June, 2012): 1651–1660.

Zamba, K. D., Panagiotis Tsiamyrtzis, and Douglas M. Hawkins. "A Sequential Bayesian Control Model for Influenza-Like Illnesses and Early Detection of Intentional Outbreaks." *Quality Engineering* 20, no. 4 (Oct., 2008): 495–507.

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